OCTOBER 1956—SIXTY-THIRD YEAR

MACHINERY

FOR 10 YEARS
the **M-R-C** *Synthe-Seal* bearing
has cut manufacturing
and maintenance costs

M-R-C "Synthe-Seal" is a standard width ball bearing with removable synthetic rubber seals—

KEEPS LUBRICANT IN—KEEPS DIRT OUT!

M-R-C Strom SRB GURNEY BALL BEARINGS

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y.

Heald VERSATILITY in action

How a STANDARD* Plain Internal Grinder SAVED IDLE MACHINE TIME

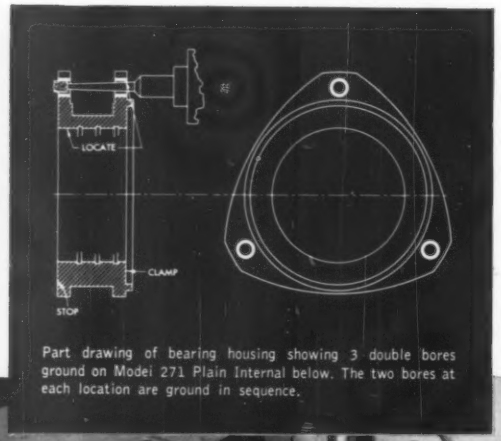
Heald Model 271 does a month's production ALL IN A DAY'S WORK . . . and can do many other jobs in its "spare time"

THE race is not always to the swift. For example: An aircraft manufacturer requested a quotation on a Model 271 Size-Matic for grinding three double bores in a bearing housing. Production requirements — 25 parts per month. A high-speed Size-Matic would do the whole job in less than a day — and be idle the rest of the time. So Heald engineers recommended a Model 271 Plain Internal instead. This *semi-automatic* machine could still do the whole month's production in one day — yet because of its inherent *versatility*, the standard Plain machine could be used for many other internal grinding jobs in its "spare time".

This solution to the problem not only saved on the initial investment, but avoided idle machine time and contributed to greater productivity and lower costs. The 271 Plain Internal, and the job for which it was ordered, are shown below. For the *best answer* to any precision finishing problem . . .

It PAYS to come to Heald

**Send for Bulletin 2-2569-1, Issue 1.*



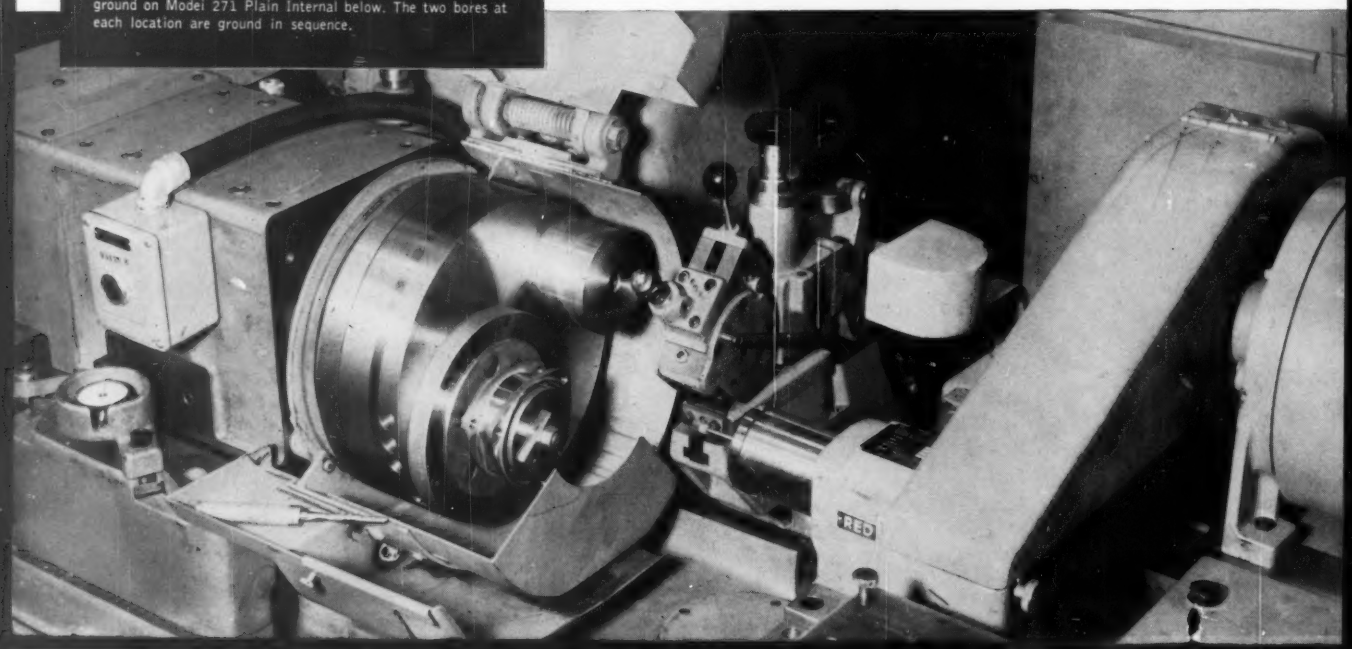
Part drawing of bearing housing showing 3 double bores ground on Model 271 Plain Internal below. The two bores at each location are ground in sequence.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York



MACHINERY
Editorial, Advertising, and Circulation Offices
93 Worth St., New York 13, N. Y.

•

Editor
CHARLES O. HERB

•

Managing Editor
CHARLES H. WICK

Associate Editors
FREEMAN C. DUSTON
EDGAR ALTHOLZ
RAYMOND H. SPIOTTA

Materials Editor
PAUL B. SCHUBERT

Shop Mathematics Editor
HENRY H. RYFFEL

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Advertising Representatives

WALTER E. ROBINSON
DWIGHT COOK
93 Worth St., New York 13, N. Y.

GEORGE H. BUEHLER
228 N. LaSalle St., Chicago 1, Ill.

NORMAN O. WYNKOOP, Jr.
15937 W. Seven Mile Road
Detroit 35, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St.
Los Angeles 17, Calif.

RICHARD E. HOIERMAN
2831 El Capitan St., Dallas 28, Tex.

FRED W. SMITH
1212—41st St.
Belview Heights, Birmingham, Ala.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices, 93 Worth St., New York 13, N.Y.

Subscription rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies, 50 cents. Changes in address must be received by the tenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1956 by The Industrial Press.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed by Hildreth Press, Inc., Bristol, Conn., U.S.A.

British Address
MACHINERY
National House, West St.
Brighton 1, England

French Address
LA MACHINE MODERNE
15, Rue Bleue
Paris-IXe, France

MACHINERY

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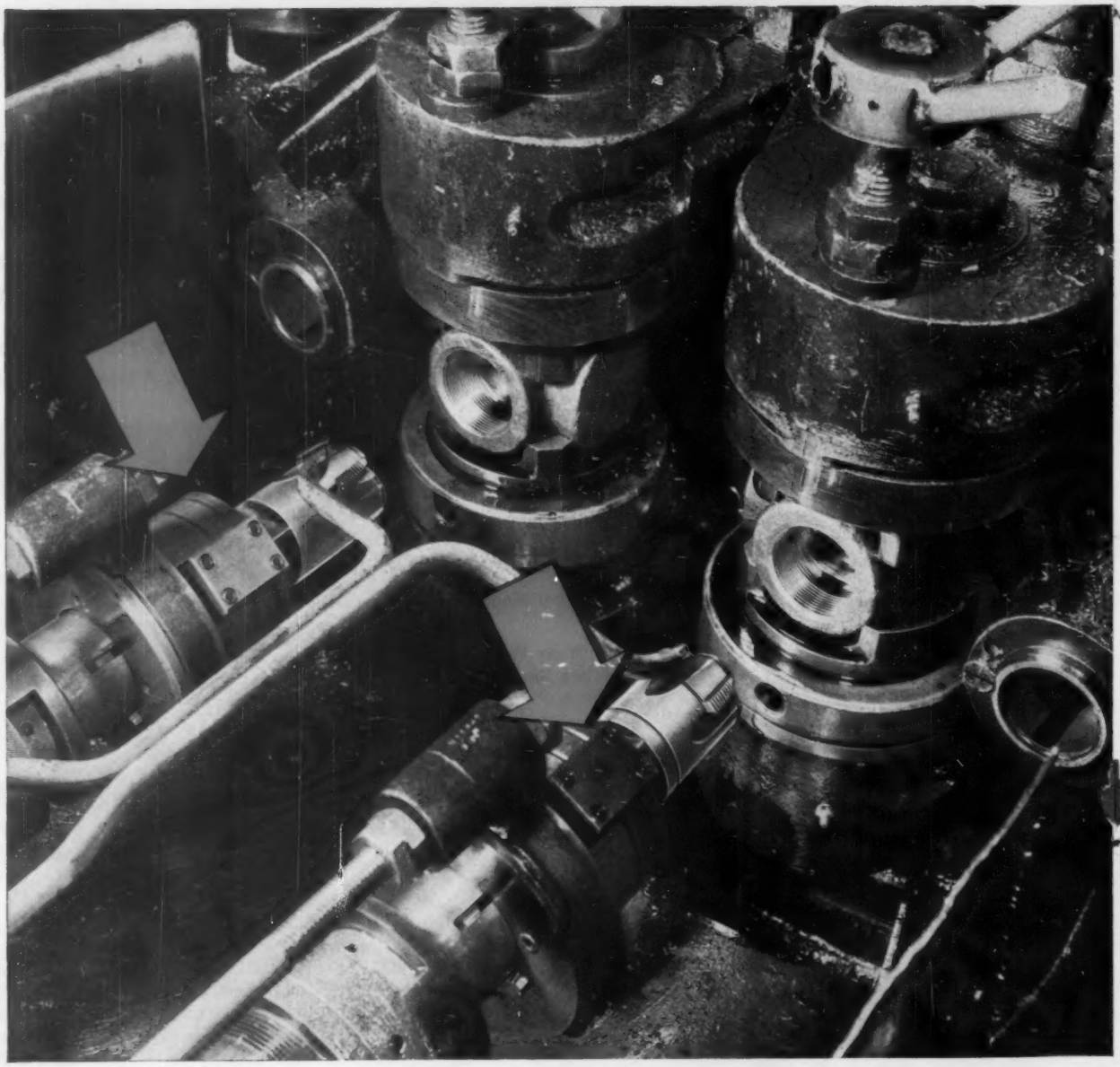


TAPERED THREADS

produced with *LOW* Tool Cost by receding *TAP*

"Receding action" enables the LANDIS LL Tap to thread 4000 W-S pipe fittings per grind at production rates to close tolerances.

This action produces a tapered thread of great accuracy because it mechanically withdraws the chasers from the work at a rate equal to the taper of the thread being produced. Cutting strains are reduced, a true conical thread produced, thread finish improved, and chaser life lengthened.

W-S pipe fittings are produced by the Watson-Stillman Fittings Division of the H. K. Porter Co., Inc. (Roselle, N.J.) for high pressure pipe lines. In the particular operation illustrated, two LANDIS LL Rotary Taps on a special drilling and tapping machine are threading Forged Steel Pipe Elbows. 2" 11½ pitch ASTP threads are tapped at 35 s.f.m.—with 4000 threads completed between chaser grinds.

The LL Tap is also well-suited for threading Stainless Steel. Its cutting action is limited to the throat section or chamfer of the chaser, tapping the thread quickly with little cold-working. As on all LANDIS Taps, detachable heads allow each size of Tap Body to produce a wide range of thread diameters.

For further information, send specifications and ask for Bulletin G-95.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

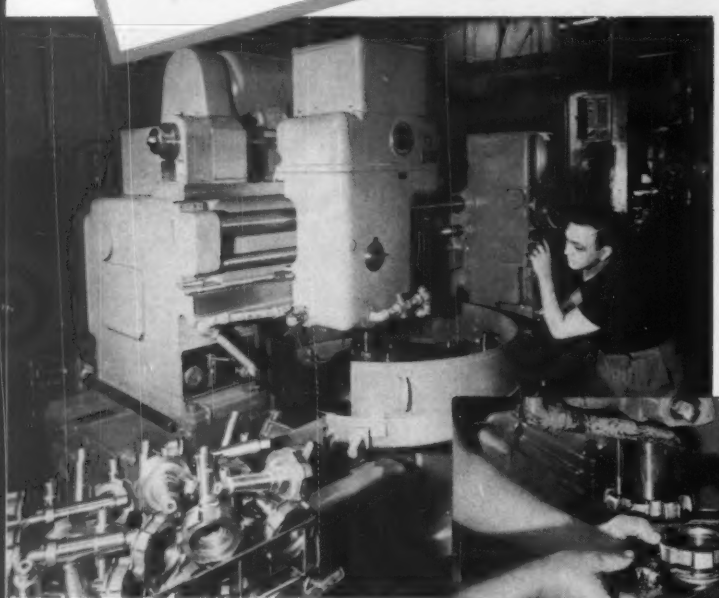
LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

JUST THE TICKET for Versatility

FELLOWS GEAR

New "540" Transmission, made for a major truck manufacturer, includes 22 gears . . . all produced on powerful, accurate Fellows Machines.



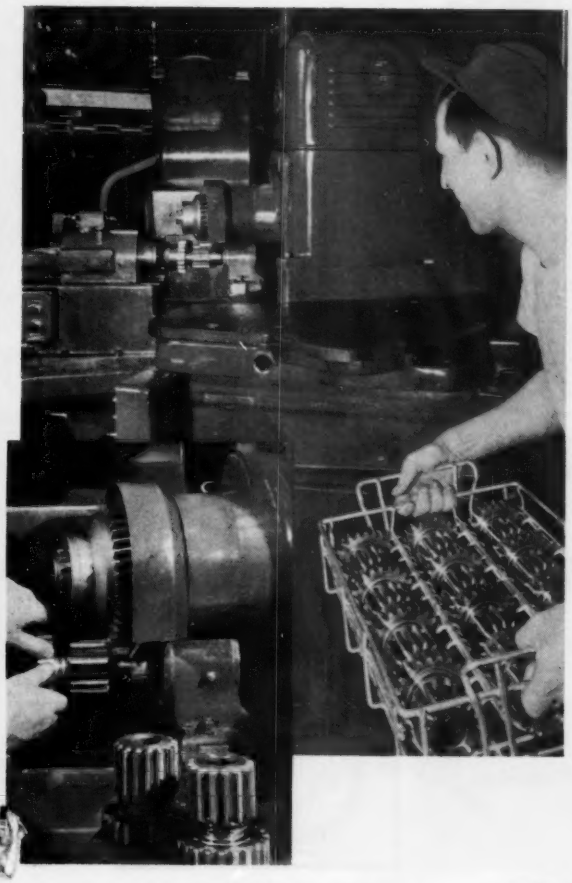
Fellows 36-Type Gear Shaper cuts all six lugs on this part in one operation...produces 135 finished parts per day.

Fellows No. 8 "Full-tool" Shaver produces 40 pieces per hour compared to 25 on previous machine.

THE PRECISION LINE

and High Production...

PRODUCTION EQUIPMENT



Products as varied in size as sewing machines and truck transmissions are made at the famous New Process Gear Company, major gear manufacturers for seventy years. They rely on versatile Fellows Gear Production Equipment for higher production schedules, increasing production and cutting costs more than 50% on many gears.

For example, Fellows 36-Type Gear Shaper, with a capacity up to 36" P.D., turns out gears in as little as *one-fifth* the time of the machine it replaced! Fellows No. 8 "Full-tool" Shavers increase production over 60% on most jobs. Semi-automatic fixture controls cut loading time nearly 50%. Other Fellows machines produce comparable savings on many New Process jobs.

For full information about the benefits of the complete Precision Line of Fellows Gear Production Equipment, get in touch with your Fellows Representative. Ask him, too, about the Fellows Plan for deferred payment. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*

Why Costs Go Down

with Cincinnati ML and MI

Did you ever look at a metalworking machine—or an automobile—or a kitchen ensemble—and wonder why certain features were included? You don't have to wonder why when you look at a CINCINNATI® ML or MI Milling Machine. Everything is modern as tomorrow, yet practical as the basic reason for new machine tool purchases . . . *to reduce your costs.* Just take a look at the features illustrated here and tabulated below. Advantages are quickly apparent.

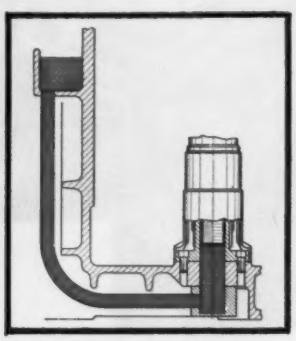
- 16 feeds, ¼" to 30" per min. Higher range optional
- 16 spindle speeds, 25 to 1500 rpm. Lower and higher ranges optional
- Single crank selection of spindle speeds with hydraulic gear shift
- Single crank selection of feeds
- Independent, directional controls
- Live rapid traverse
- Available in the styles desired by your shop
- Attachments to suit your needs

CINCINNATI ML and MI Milling Machines are unquestionably your best buy for medium duty variety milling or both variety and production milling. Want more information? Look in Sweet's Machine Tool Catalog, or write for a copy of catalog No. M-1916-1.

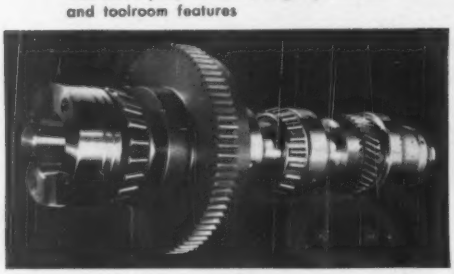
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

Automatic Table Cycle machines (Plain and Vertical styles) combine high production and toolroom features

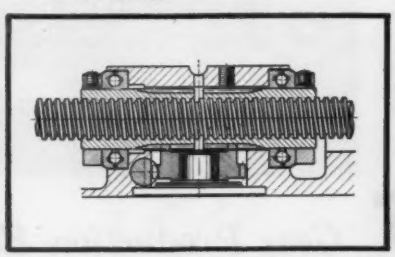
Feed rates are quickly and easily selected with a single crank-type control at the front of the knee



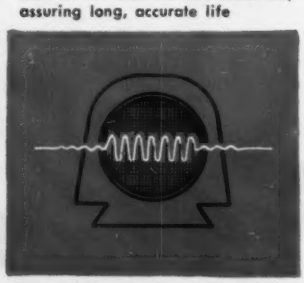
Vertical screw is submerged in a bath of oil from its own reservoir, assuring long, accurate life



Anti-friction mounting with center support for the heavy spindle assembly, smoothly transmits maximum cutting power



Automatic backlash device enables the operator to feed the table to the right or left as desired.



Dynapoise overarm smooths out the cutting action; provides straight-edge alignment for arbor supports

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES

Milling Machines on the Job

CINCINNATI No. 2 MI MILLING MACHINE
Catalog No. M-1916-1

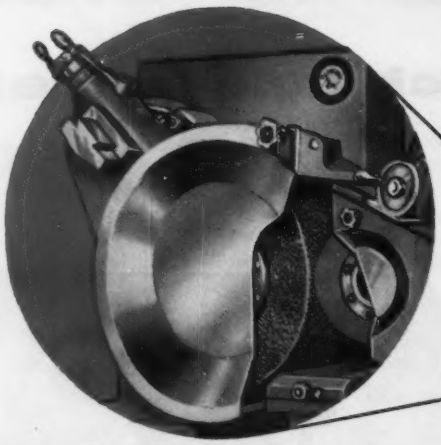
CINCINNATI

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

For more information fill in page number on Inquiry Card, on page 263

VAN NORMAN

New

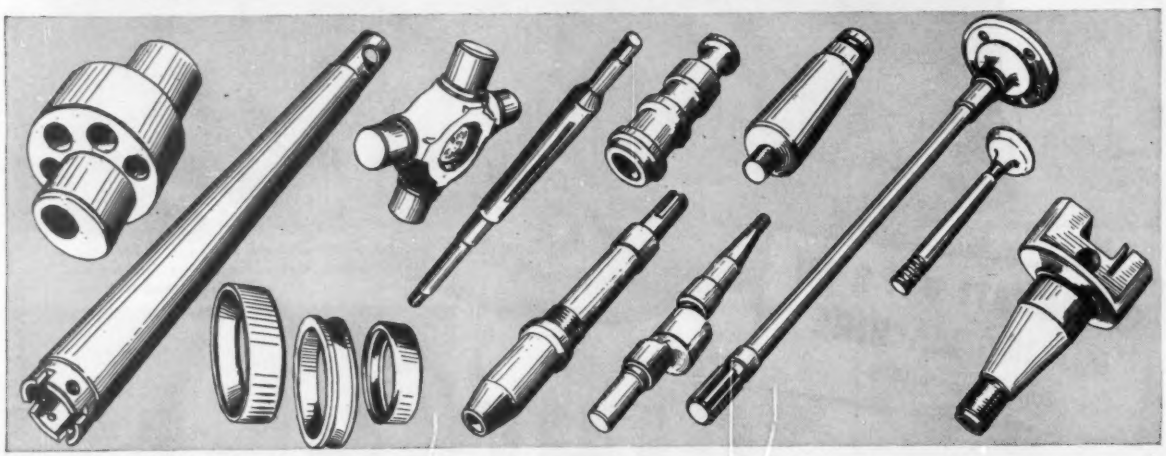


The new Van Norman No. 2C Grinder is *engineered* for fast, accurate, economical grinding of parts. Incorporated in the many outstanding features is the *15 HP* main drive motor which provides ample power for every grinding job. Couple this with the totally enclosed rugged grinding wheel spindle and you get close-tolerance smooth finishes plus chatterless, trouble-free operation.

Compare These Outstanding Features

- Hard chrome plating of regulating wheel slide after hand scraping, preserves original factory built-in accuracy.
- Grinding wheel and regulating wheel spindles are of a unit type construction . . . totally enclosed with double-row super-precision bearings, sealed and lubricated for life, assuring chatterless trouble-free operation.
- Spindles require no warm-up period, eliminating "creep" which has always been a problem in grinding operations.
- Infinitely variable regulating wheel drive.
- Totally enclosed fan cooled, dynamically balanced 15 HP main drive.
- Independent hydraulic wheel truing devices for each wheel.
- Fine hand wheel adjustment on diameter of work piece.

Phone, wire or write for full details on the new Van Norman No. 2C Centerless Grinder.



Grind Parts Like These Accurately, More Economically

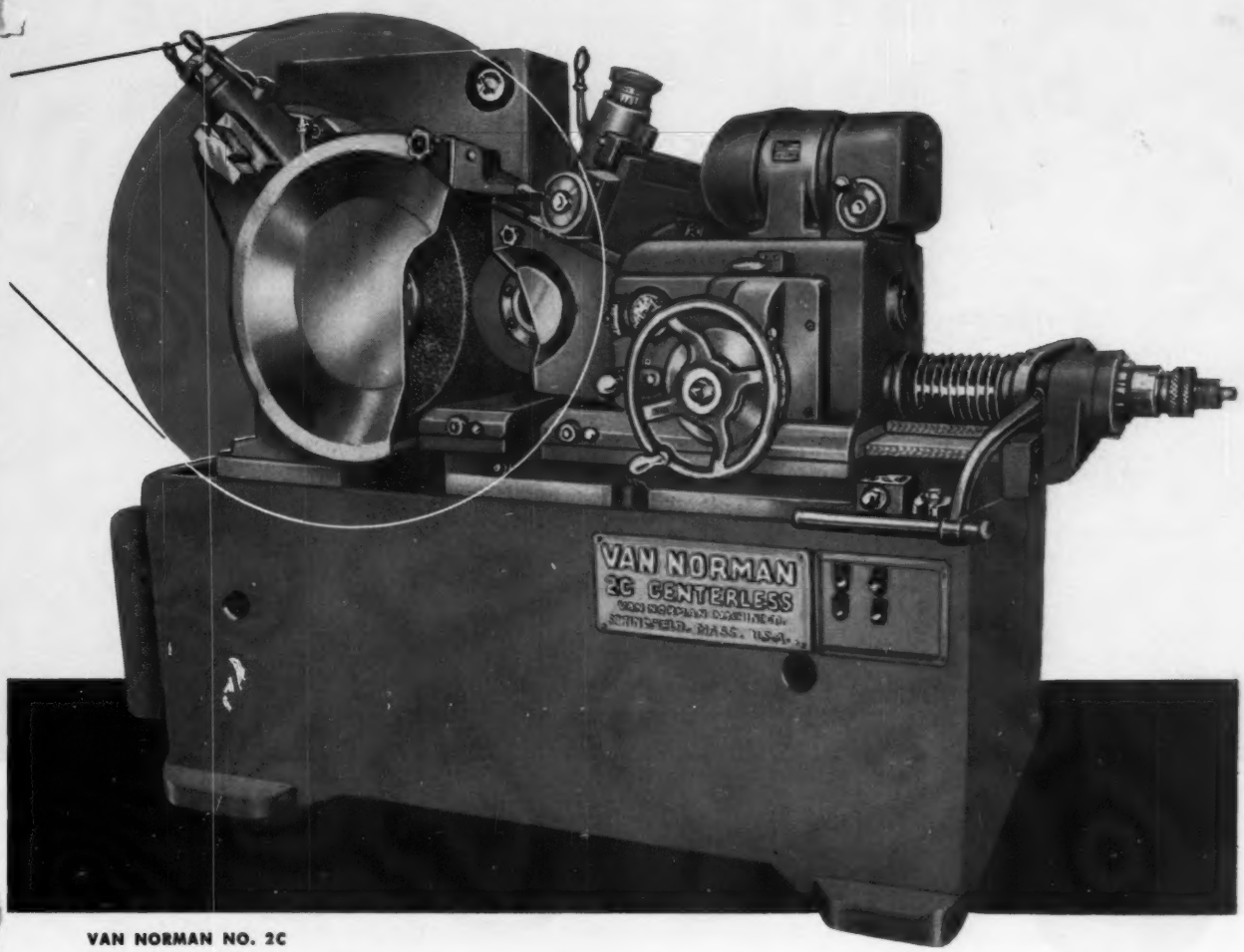
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

No. 2C Centerless Grinder

...Features 15 HP Main Drive

Assuring Precision, Close-Tolerance Grinding



VAN NORMAN NO. 2C
Capacity: 0" to 4¾"
Grinding wheels available: 24" x 4" x 12"; 24 x 6" x 12"; 24" x 8" 12"
Regulating wheels available: 12" x 4" x 5"; 12" x 6" x 5"; 12" x 8" x 5"
Automatic cycling and gauging available.

Don't wait . . . for extra profits install a Van Norman Machine now!
They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . See your dealer or write Van Norman Company. Conditional Sales Contracts not available to Export.

COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

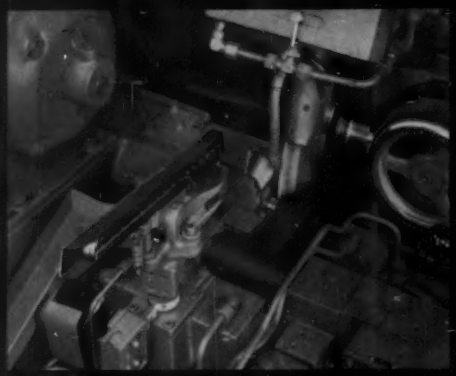
VM 6-20

For more information fill in page number on Inquiry Card, on page 263

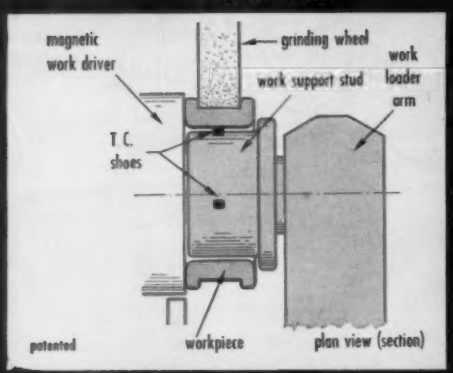
NEW automatic grinder for

Shoe-type centerless tooling

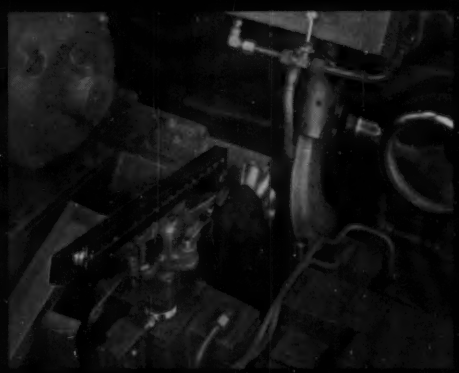
loading



grinding



grinding



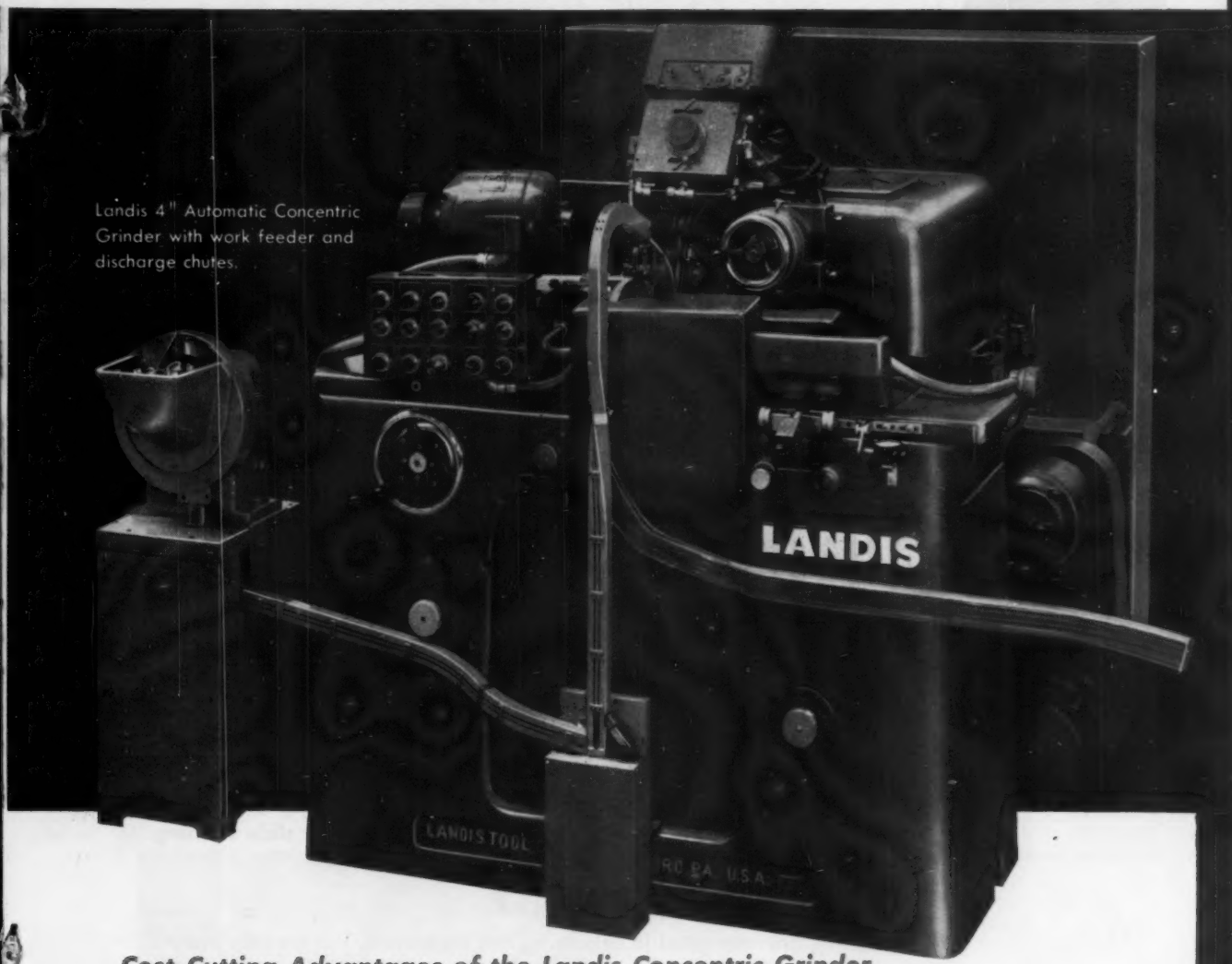
unloading

parts like these ground to precision limits—automatically

LANDIS TOOL COMPANY

large or small lot production

can be changed in less than one hour!



Landis 4" Automatic Concentric Grinder with work feeder and discharge chutes.

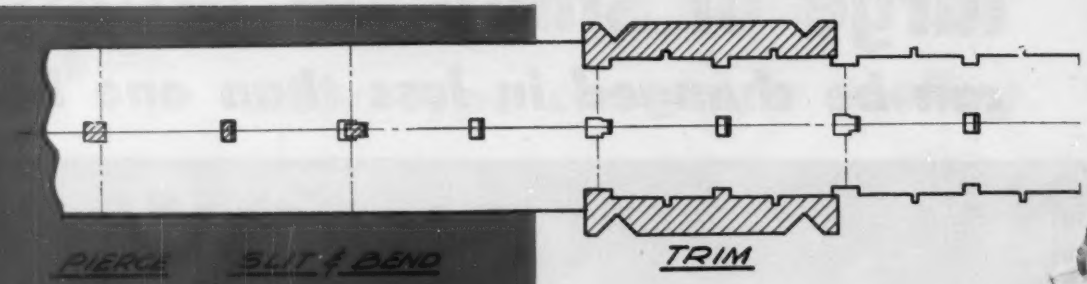
Cost-Cutting Advantages of the Landis Concentric Grinder

- Savings in set-up time make automatic operation for short runs economical.
- Super-precision results by elimination of work holding chucks, collets and arbors.
- Grinds straight or profiled workpieces.
- Automatic loading and feedback can be applied for continuous operation.
- Variable speeds and feeds for various sizes and materials.

WAYNESBORO, PENNSYLVANIA

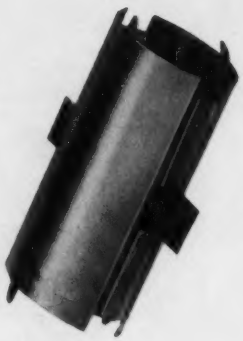
LANDIS

precision grinders



NO SECONDARY OPERATIONS!

Stamping with folded lock seam produced complete on the U. S. MULTI-SLIDE



The part illustrated above is a radio component. This formed metal stamping with folded lock seam is produced complete *without secondary handlings* on a No. 28 U. S. Multi-Slide at the rate of 175 per minute. The sequence of operations in the dies is illustrated by the strip layout at the top of the page. The operations in the four slide forming position are indicated by drawings on the opposite page.

Eliminate Secondary Operations and Reduce Costs: **You, like all manufacturers, are interested in achieving this end result. The part illustrated is just one of many different types of formed metal stampings which can be produced complete on the U. S. Multi-Slide. If stampings are included in your production program, the U. S. Multi-Slide may be the answer to your cost reduction problems. Ask for a copy of Bulletin No. 15-M containing complete specifications for the four sizes of Multi-Slides we now build.**

U.S. TOOL COMPANY, Inc.

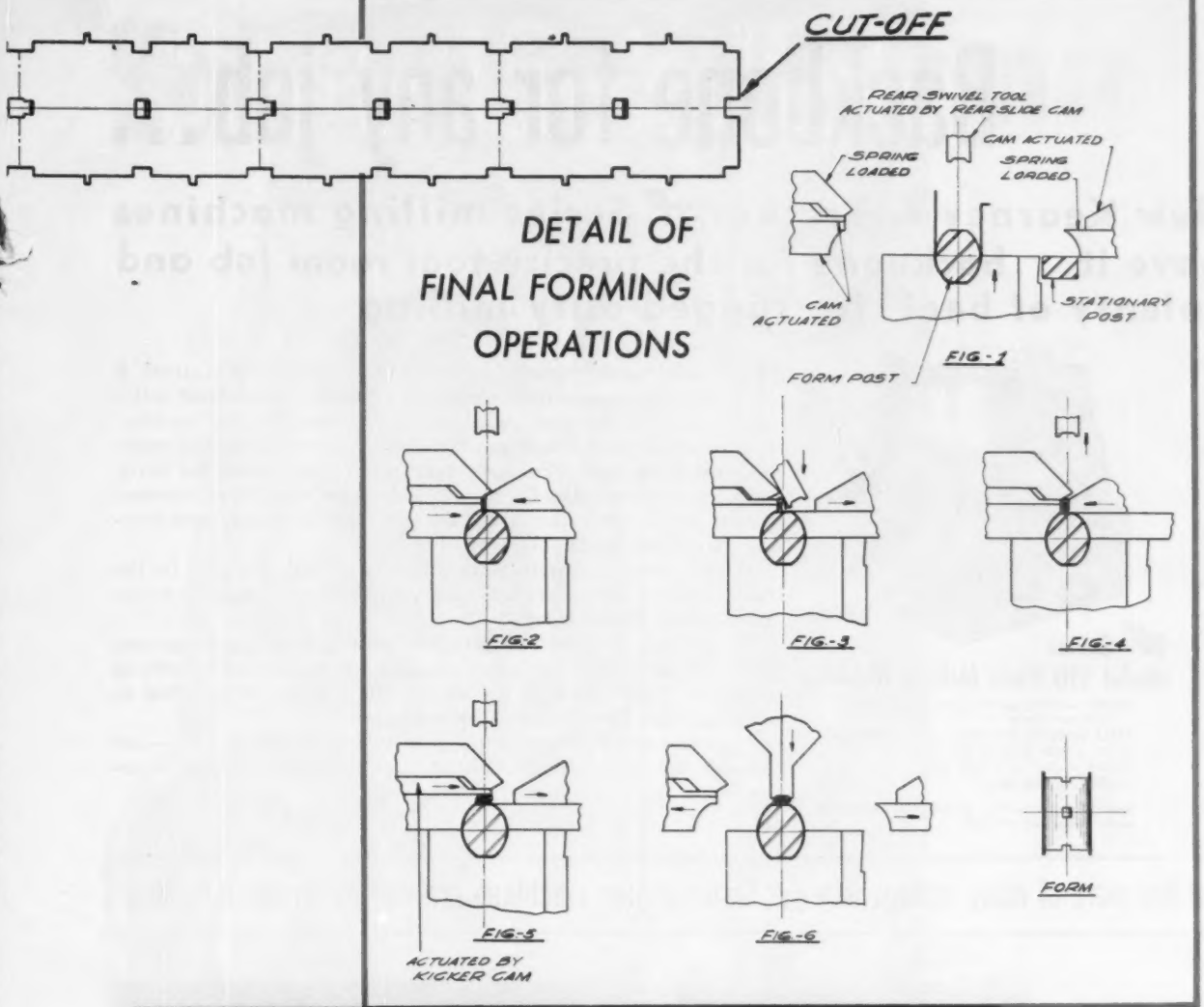
AMPERE (East Orange) NEW JERSEY

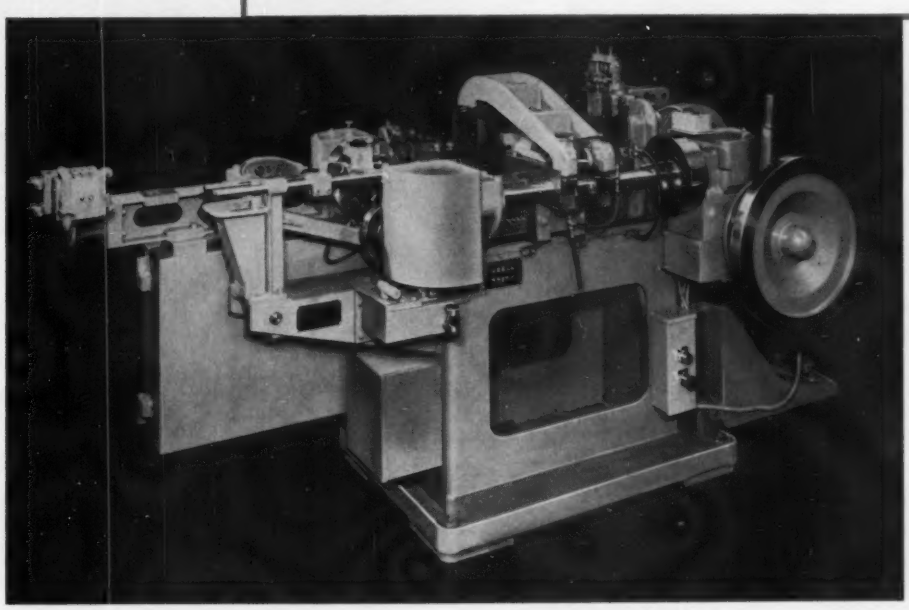
Builders of U. S. Multi-Slides

U. S. Multi-Millers

U. S. Automatic Press Room Equipment

U. S. Die Sets and Accessories

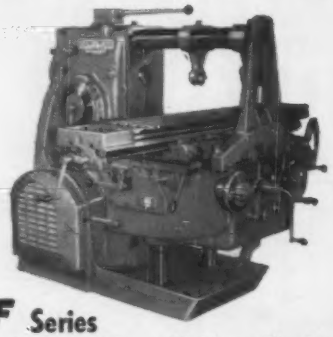




The No. 28 U.S. Multi-Slide, Symmetrical type, used to produce the radio component.

Backbone for any job...

New Kearney & Trecker TF Series milling machines have it . . . backbone for the precise tool room job and "plenty of beef" for rugged duty milling



TF Series
Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ⅜ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

New TF Series milling machines are available under Tool-Lease program

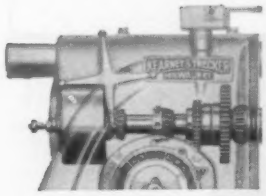
THE solid-back column is an outstanding example of Kearney & Trecker advanced engineering. This one-piece, cross-ribbed, solid-back column is the most important single element of the machine. Every inch of metal is scientifically distributed to add rigidity where it's needed the most. Thus the column readily absorbs all the heavy work loads supported by the heavier, wider knee, and also all torsional thrusts to the cutter transmitted through the heavy-duty, three-bearing spindle and double overarms.

What's more, the heavier column base is specially designed for the new, exclusive twin screw knee support — the only balanced-design arrangement offered today.

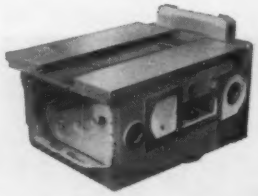
In addition, the new TF's give you other outstanding design and operating features, never before available on any knee-type milling machines. They're built in five sizes — No. 2 to No. 6 from 10hp to 50hp in Plain, Universal and Vertical styles.

For facts and figures that will help you — ask about TF's — the latest in milling machines. Contact your Kearney & Trecker representative — call him or mail coupon direct to factory today.

A few more of many reasons why TF Series milling machines are way out front in rigidity



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life . . . excellent finish . . . quieter and vibrationless operation.



Heavier, Wider, One-Piece Knee — The *twin screw* arrangement supports the heavier, larger knee. Span and length of ways are increased considerably, providing fuller saddle support . . . long-lasting accuracy.

Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....

"Solid-Back" Column

see our catalog in S or write for copy

KEARNEY & TRECKER
MILWAUKEE ®

DESIGNERS AND BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

the latest word in low cost machining

televersal

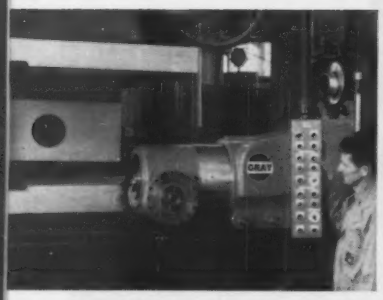
This new GRAY TELEVERSAL head tremendously increases machining range. Conveniently applied, quickly positioned, its great rigidity permits highest horsepower milling cuts.

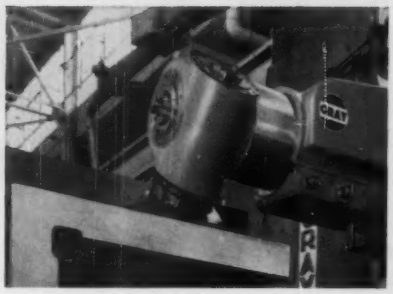
The large diameter quill may be swiveled to permit any angular cut. A triple-straddle clamp inflexibly locks the quill to the cast pyramid body.

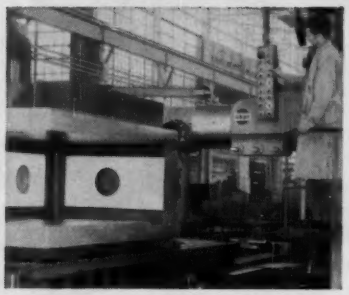
Designed to keep the job low and yet permit great machining range. Ideal when used with column cross travel of the new GRAY horizontal, boring, drilling and milling machine.

Not just an attachment, but a high power massively built, heavy milling unit that offers a new concept in versatility.

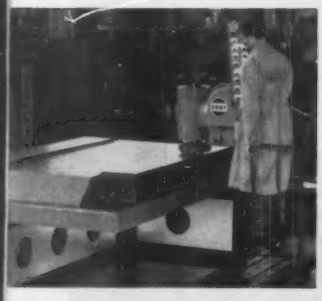
The G. A. GRAY Co., Cincinnati, Ohio

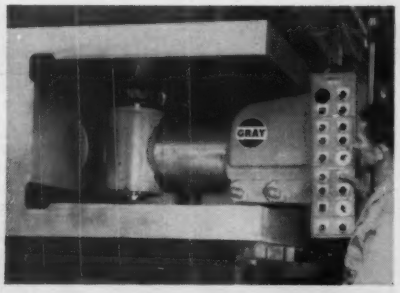


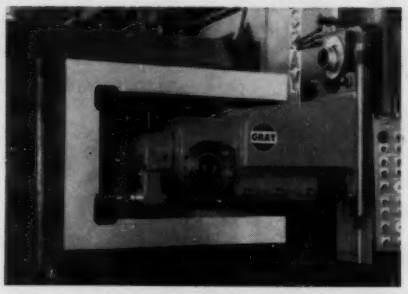




six different surfaces and more ... and only ONE work-setting







GRAY
GRAY
GRAY

FRIDEN Calculating Machine Co., Inc. of San Leandro, Calif., makes these components on CLEVELAND 3" Model AB DIALMATICS...

. . . to such accuracy they are assembled into precision aircraft navigation instrument without further machining other than some deburring!

John Prohaska, vice president of Cleveland Automatic and Jay DiFabio, test department foreman, admiring aircraft instrument components produced by the Friden Company on two Cleveland Dialmatics—identical to the machines shown in the background. Friden produces these parts in runs of from 500 to 2000 pieces.

Shown are a few of some 30 instrument components produced on two Cleveland Dialmatics at Friden Calculating Machine Co., Inc. Machined from aluminum and stainless steel, these parts are characterized by extremely thin sections—intricately stepped and recessed i. d.'s—many trepanning operations—fine pitch threading—clean, sharp knurling—beautiful finish—*with most dimensions held to* 0.001"; *many to* 0.0005".

That these parts are produced *complete* on the Cleveland Dialmatics—rather than first roughed out, then finished to required tolerances by grinding—is a tribute both to the skillful tooling by Friden engineers and to the capabilities of the Cleveland Single Spindle Automatics. The Cleveland's rigidity and accuracy of operation—range of spindle speeds—flexibility of control—ease and rapidity of set up—contributed to produce some of the finest screw machine work we have ever seen.

Could a single spindle bar automatic possessing these qualifications assist *your company* to more and better production at less cost? Let a Cleveland sales engineer give you complete information. For a description of machine details and specifications, write for new 8-page bulletin.

Remember: *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

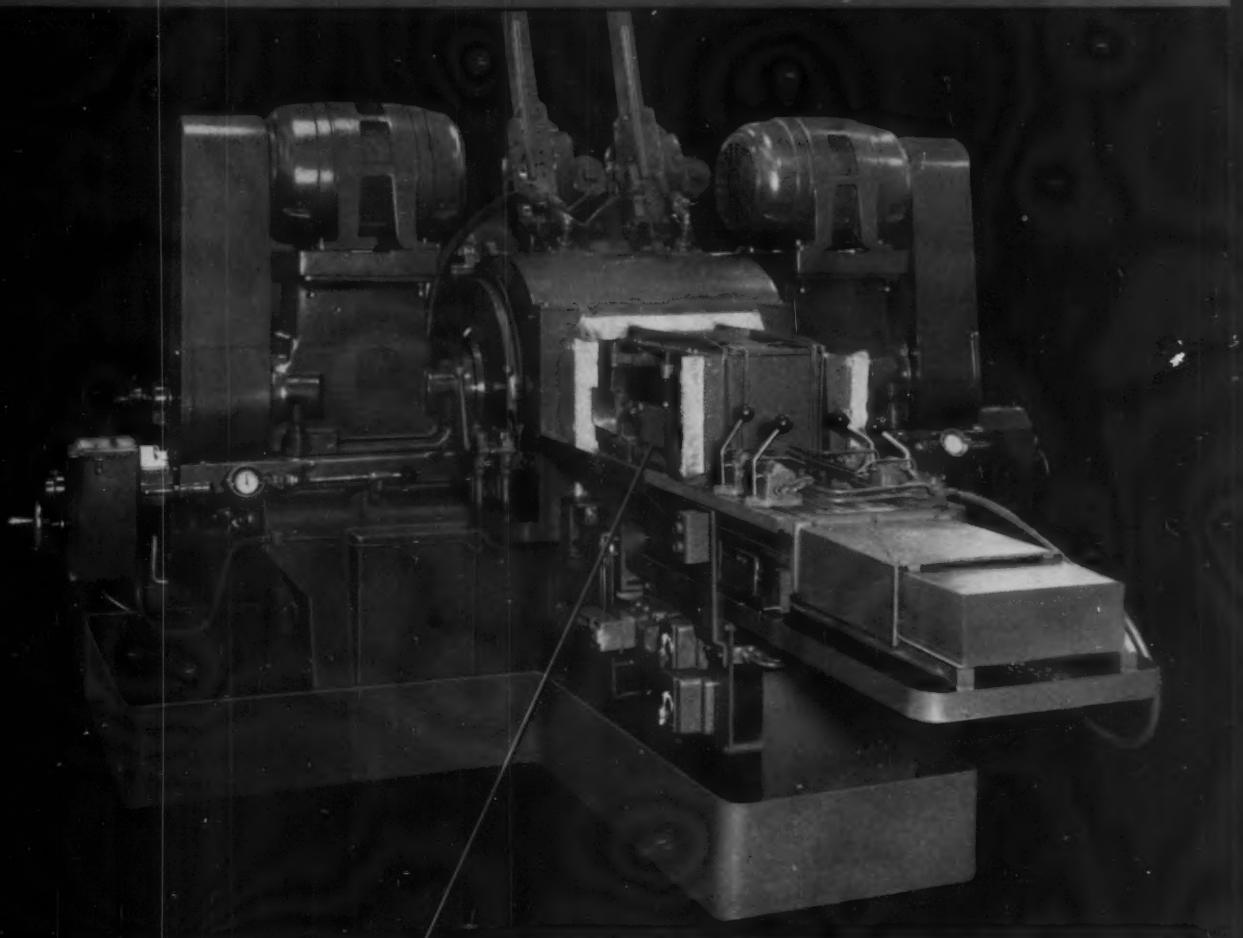
4936 Beech Street
Cincinnati 12, Ohio

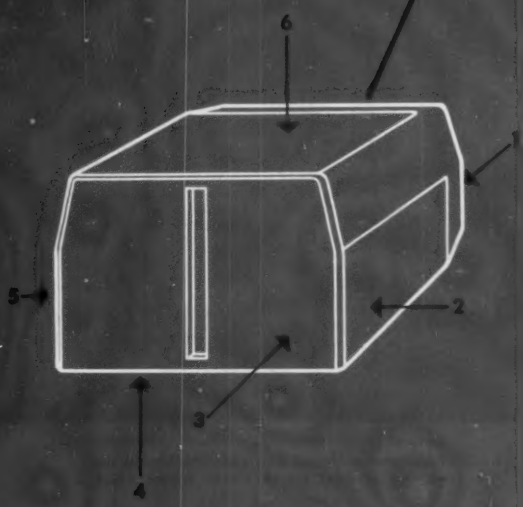
SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information fill in page number on Inquiry Card, on page 263

Disc Grinder tooled to sequence-grind non-parallel surfaces





Double disc grinding single surfaces of steel cement block cores, of several sizes, four at a time. A total of six surfaces are ground—four of which are not parallel. Tooling includes air-operated work clamping, hydraulically-operated work table.

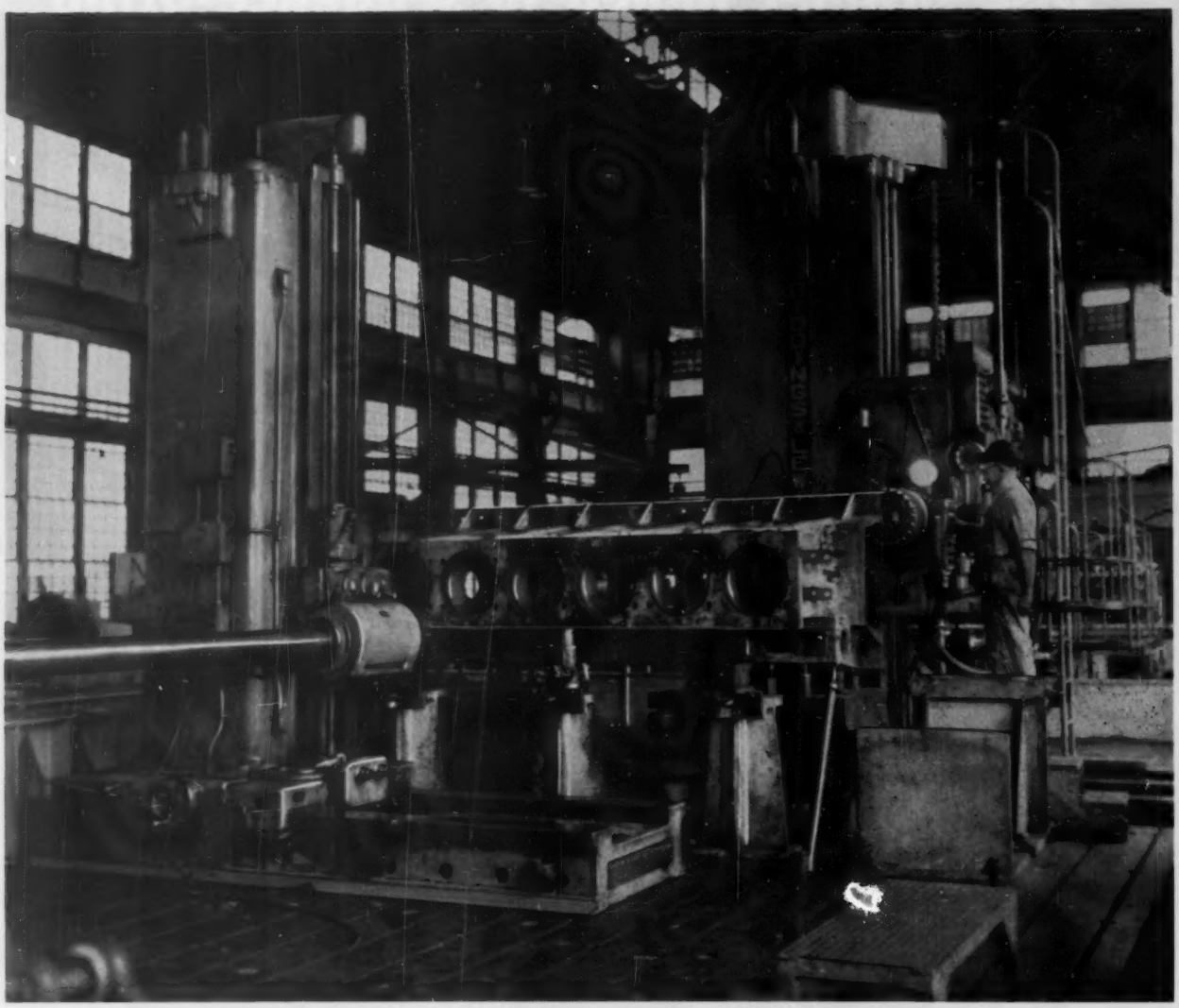
Operating Data:

PRODUCTION: 120 surfaces per hr.
STOCK REMOVAL: 3/32" per side
FLATNESS: .002"
UNIFORMITY: .005"

GARDNER

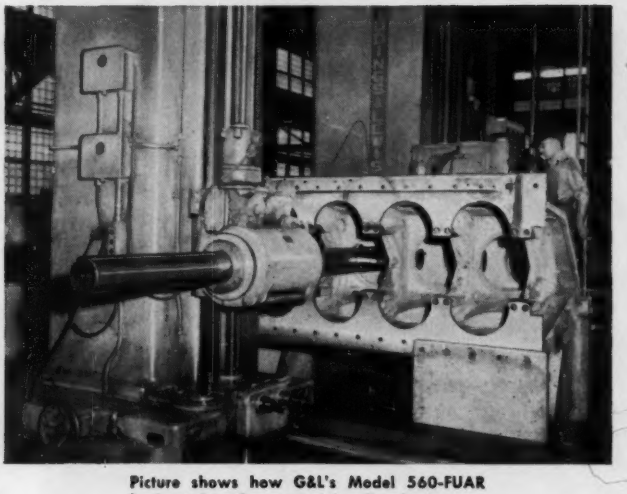
precision disc grinders

BELOIT, WISCONSIN



In operation at the Junianta, Pa., diesel shop of the Pennsylvania R. R., this versatile Giddings & Lewis Model 560-FUAR (floor-type) horizontal boring, drilling and milling machine performs milling and boring operations to precision tolerances on 6-cylinder engine blocks.

Giddings & Lewis Model 560-FUAR horizontal is shown finish milling the bottom rail on a 6-cylinder engine block for diesel engine.



Picture shows how G&L's Model 560-FUAR horizontal performs precision line boring operation of liner pit in diesel engine block.

SAVE time and setups

machining 6-cylinder engine blocks at railroad diesel shops

Giddings & Lewis Model 560-FUAR (floor-type) horizontal boring, drilling and milling machine is equipped with a 6" dia. spindle, underarm spindle support and end support on runway. It insures maximum productive capacity at the Pennsylvania R. R. diesel shops in Altoona, Pa. This highly versatile machine is used for milling the bottom rails and boring on 6-cylinder Baldwin engine blocks.

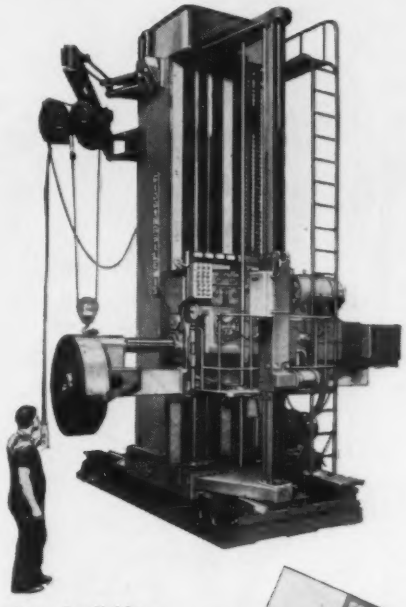
Rugged in construction, this Model 560-FUAR mills bottom rails with a 14" diameter face mill cutter with carbide tips. It also rough and finish bores to exact tolerances the six 14.750" diameter cylinder holes, using a 6" boring bar equipped with a Davis regular type two-cutter block.

What's more, when this machine is equipped with G&L's broad line of optional equipment and accessories, you can perform a wide variety of machining operations beyond the range of standard machines.

For more information on how this machine can help you increase production and lower costs, see your G&L representative, or write to factory.

Giddings & Lewis Model 570-FUAR Horizontal Boring, Drilling and Milling machine features broad line of *OPTIONAL EQUIPMENT:*

- 7-inch diameter spindle with underarm support for mounting such productive machining attachments as shaper-slotter head, angular milling attachment, 46-inch face plate drive and 48-inch continuous feed facing and boring head.
- Power hoist, mounted integrally with the machine column, facilitates handling and setting up of heavy accessories.
- Built-in elevator on machine's 21-foot column enables the operator to select the most ideal working position in relation to the headstock and work. Elevator operates independently of the machine headstock, or simultaneously with headstock as desired.
- Three independently operated d-c drive motors assure maximum flexibility for profiling and contour milling operations.



Literature Available:
For complete specifications on G&L 50 Series (floor-type) horizontal boring, drilling and milling machines, ask for Catalog No. 50-F.

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

G-63

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Machines.

Power and rigidity of Warner & interrupted —BOOST

AT
R. H. LITTLE
COMPANY

Swasey 4-A easily handle severe cuts in tough steel casting

PRODUCTION 200%!

Once again, the cost-cutting combination of power, rigidity and accuracy built into all Warner & Swaseys has more than doubled production—this time up to 200% for the R. H. Little Company of Canton, Ohio.

ENCLOSURES OF SAE 1045 cast steel for diesel-electric locomotive journals, designed by The Timken Roller Bearing Company, are run in 500-piece lots at the rate of 12 to 15 daily on Little's new Warner & Swasey 4-A Extra-Heavy Duty Saddle Type Turret Lathe.

The part has ⅛ to ⅜-inch stock per side. In addition to heavy stock removal, severely-interrupted cuts put a terrific strain on both tooling and the machine. Power and rigidity of the 4-A easily handle the job. On the first operation involving combined and multiple cuts—four in all—metal removal is equivalent to 1½ inches. Three cuts—two turning and one boring—are taken from the hexagon turret combined with a facing cut from the square turret. Carbide tooling roughs the part at 250 SFM—.017 inch feed; finishing operations are at 400 SFM.

This same casting was previously machined at the rate of only 5 a day when run on a 20-year-old lathe. Production was held down due to the machine's lack of horsepower and rigidity. This caused excessive downtime for tool changing and required constant operator attention to the maintenance of longitudinal and diametrical tolerances.

When you require extreme machining accuracy, with heavy metal removal, call the Warner & Swasey Field Representative. He will discuss with you how the job can be handled most efficiently.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS ... WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

ARMSTRONG

Quality TOOLS

More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS

TEMPER, TEMPER!

If Grinding Wheel problems have you fighting mad, why horse around? Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if you have grinding problems as tough as trying to tame wild horses, just contact your CINCINNATI Grinding Wheels distributor. He'll be glad to explain how (PD) WHEELS can make life serene once more. Or, contact us direct and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

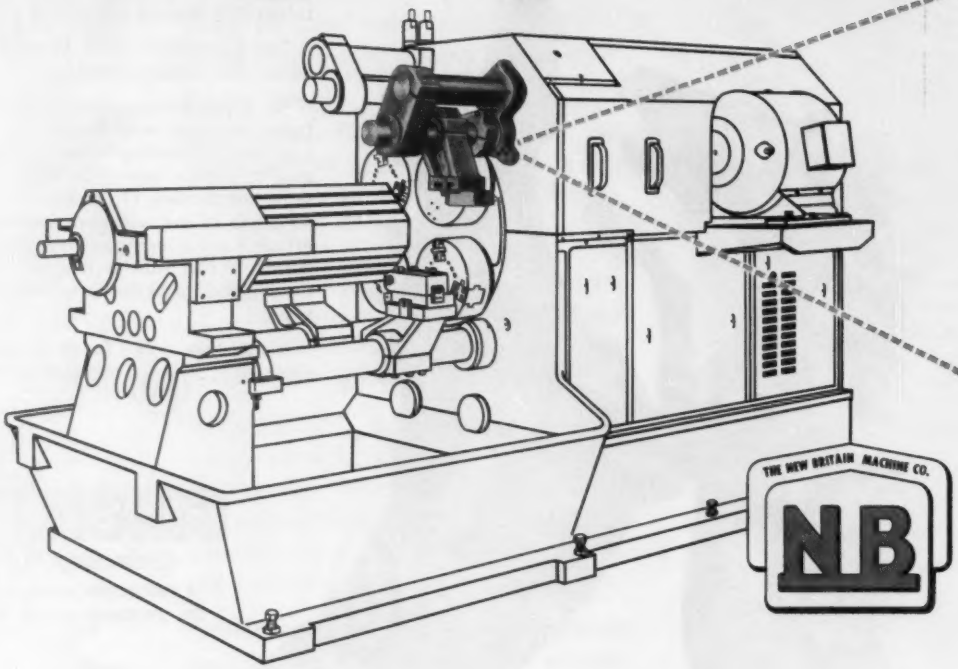
Remember—*only* CINCINNATI Grinding Wheels give you . . . (PD) POSITIVE DUPLICATION.

CINCINNATI°
Grinding Wheels
A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

° Trade Mark Reg. U. S. Pat. Off.

Only **New Britain** *Chuckers offer the EXTRA advantages of*

swinging arms

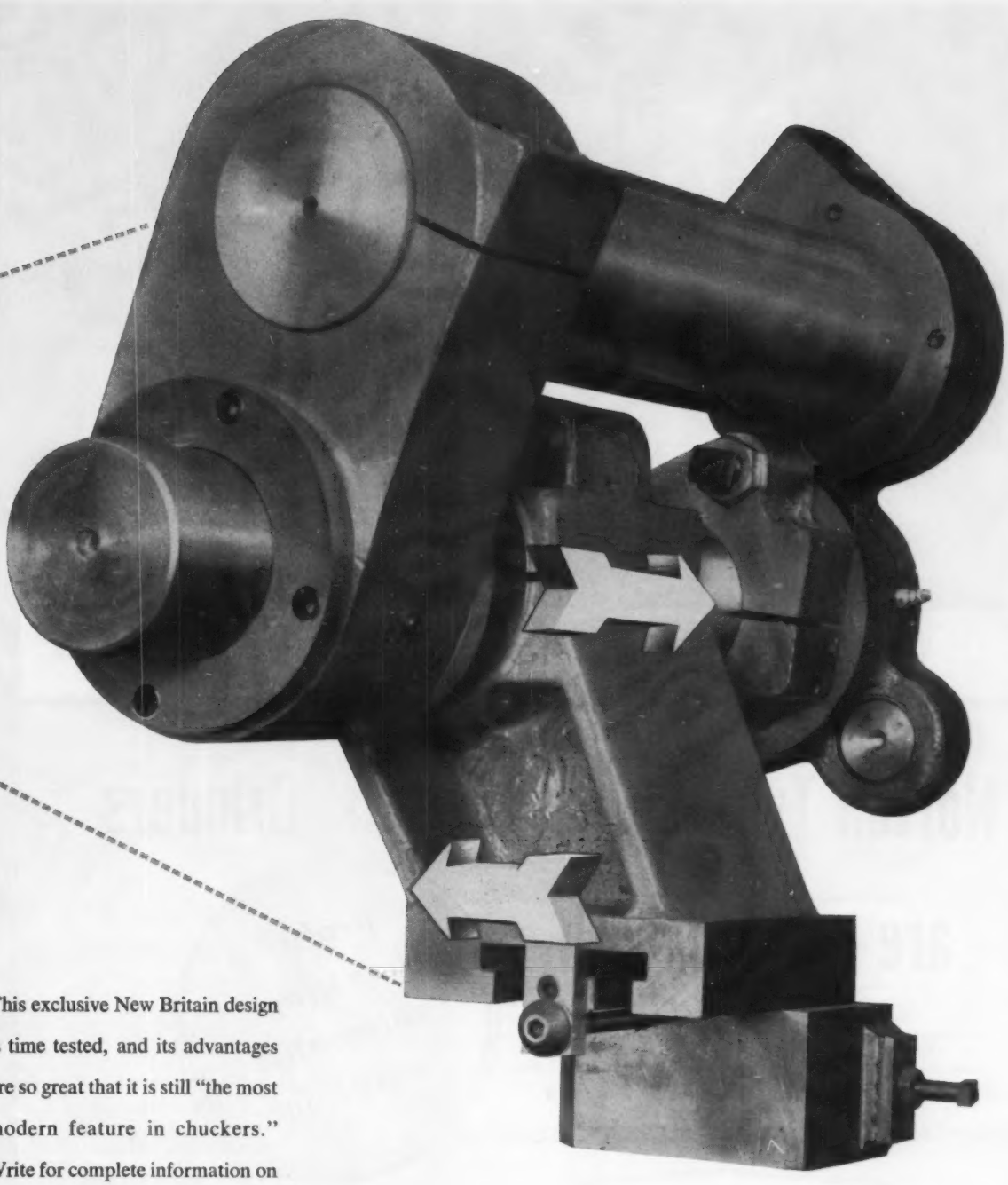


Independent swinging type arms have the PLUS advantage of *longitudinal* action. The combination of radial and longitudinal motion permits a variety of operations which often makes the difference between a single machining and the need for secondary operations.

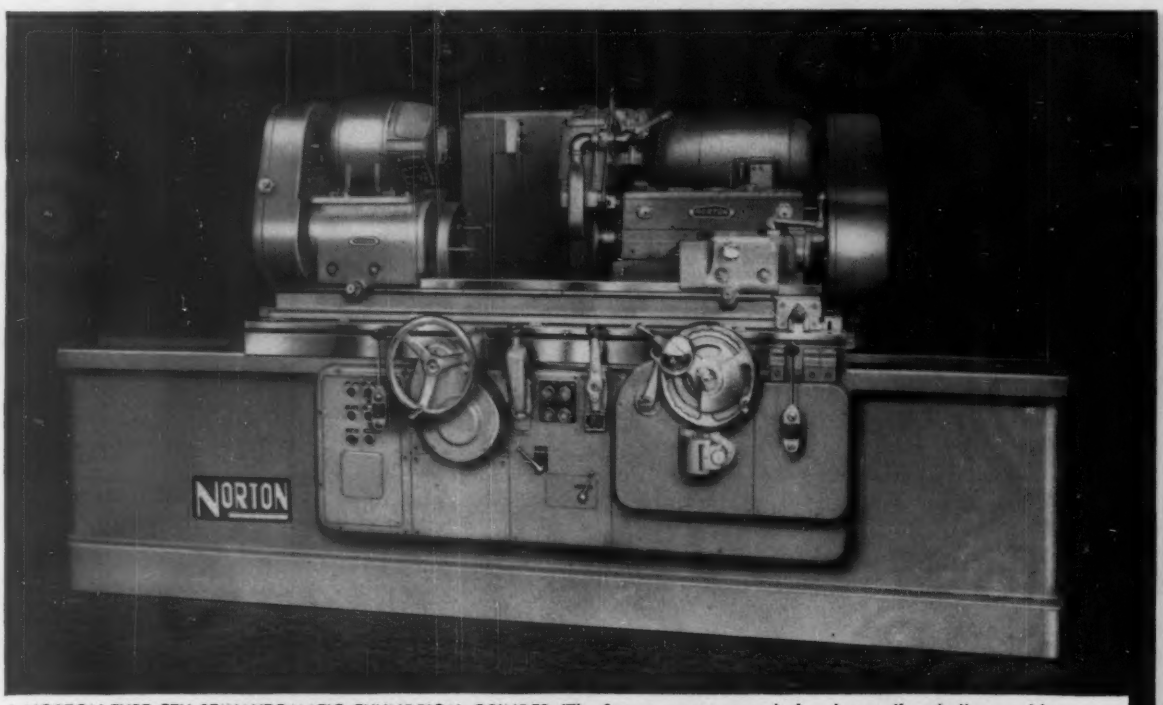
Arms are positionable horizontally for *any length of work*, and each is operated independently through separate cams. Bearing surfaces are located away from wear-producing grit and grime. Together with New Britain open-end construction, swinging arms afford wide-open accessibility and more chip room.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

The New Britain Machine Company — New Britain, Connecticut



This exclusive New Britain design is time tested, and its advantages are so great that it is still "the most modern feature in chuckers." Write for complete information on New Britain four-, six-, and eight-spindle machines, *now* with chucking diameters up to 15 inches.



A NORTON TYPE CTU SEMIAUTOMATIC CYLINDRICAL GRINDER. The fastest, most economical and versatile grinding machine of its type. One-lever control of the automatic grinding cycle reduces the operator's duties to loading and unloading. Both the 6" and 10" Type CTU's are available as semiautomatics or as plain machines.

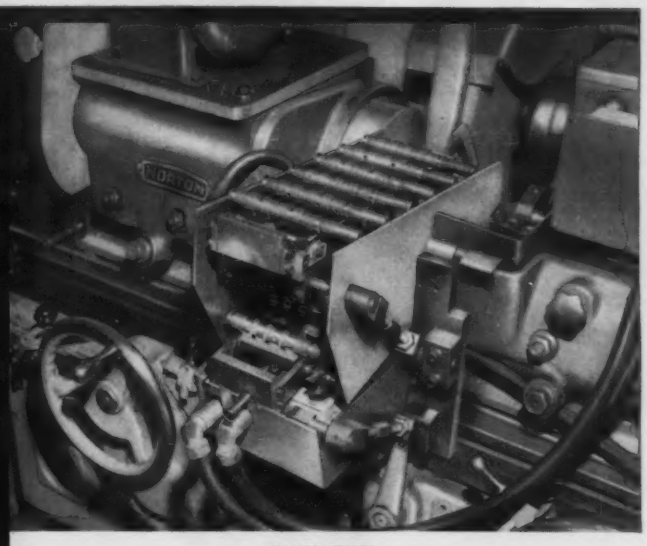
Norton Type CTU Cylindrical Grinders are packed with features for...

Production line and job shop users report that Norton 6" and 10" Type CTU cylindrical grinders have doubled and tripled production, replaced several machines and eliminated costly extra operations.

That's because of the many time-and-work-saving "Touch of Gold" features — standard and auxiliary — available with these grinders.

Some of the expertly automated auxiliary features are described here. Check them carefully — and figure their value to your own cylindrical grinding operations. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. For further facts, see your Norton Representative, or write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

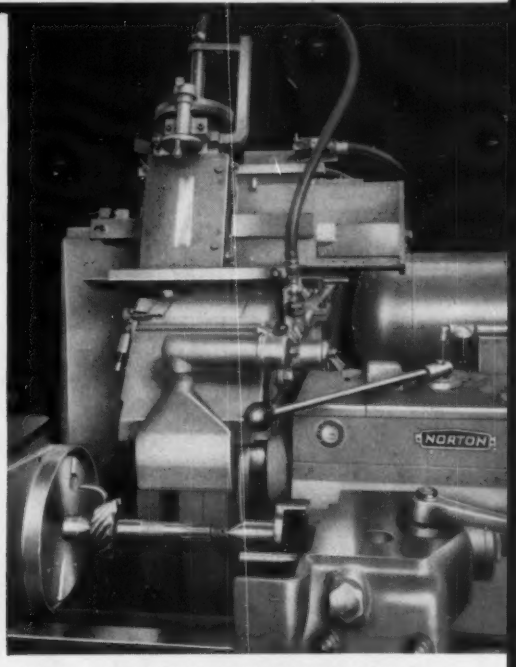
THE SWIVALIGN* ELIMINATES CUT-AND-TRY. Another Norton "Touch of Gold" development for faster, better, lower cost grinding. The SWIVALIGN Dual Electric Indicator, available for Norton cylindrical and universal grinders, enables operators to adjust the angular positions of swivel tables quickly and accurately, eliminating the usual cut-and-try guesswork. Featuring positive response and easy operation, this accurate instrument saves grinding time and money.



RAIL TYPE

TURRET TYPE

YOUR CHOICE OF AUTOMATIC LOADING DEVICES. Two types of Norton automatic loading devices are obtainable with 6" and 10" Type CTU semiautomatic grinders. The rail type loader is designed to handle a variety of small shafts. The turret type loader handles workpieces which must be chucked. Thanks to their steadily paced, automatic operation these Norton-developed loading mechanisms can be adapted to full automation. Or, they make it possible for one operator to tend a battery of machines, speeding production and cutting unit costs day after day.



WHEEL HEAD MOUNTED AUTOMATIC TRUING OFFERS BIG ADVANTAGES. A Norton automatic truing device, as shown here on a Type CTU grinder, quickly repays its original cost. It speeds up production, increases wheel life and increases diamond life. Also, it decreases the skill and effort required with hand truing. Operation is extremely simple. Once the original settings are made, all you do is push a button. Then the diamond automatically makes its round trip across the wheel face, at pre-determined speed and feed. Easy adjustments assure correct settings for each job . . . Another step forward in automatic grinding!

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

District Offices: Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit

*SWIVALIGN — Norton trade name for Dual Electric Indicator for accurate measurements of swivel table adjustment.

Buhr (43 STATION)

ECONOMATIC

performs
84 operations
every 21 seconds!

OPERATIONS...

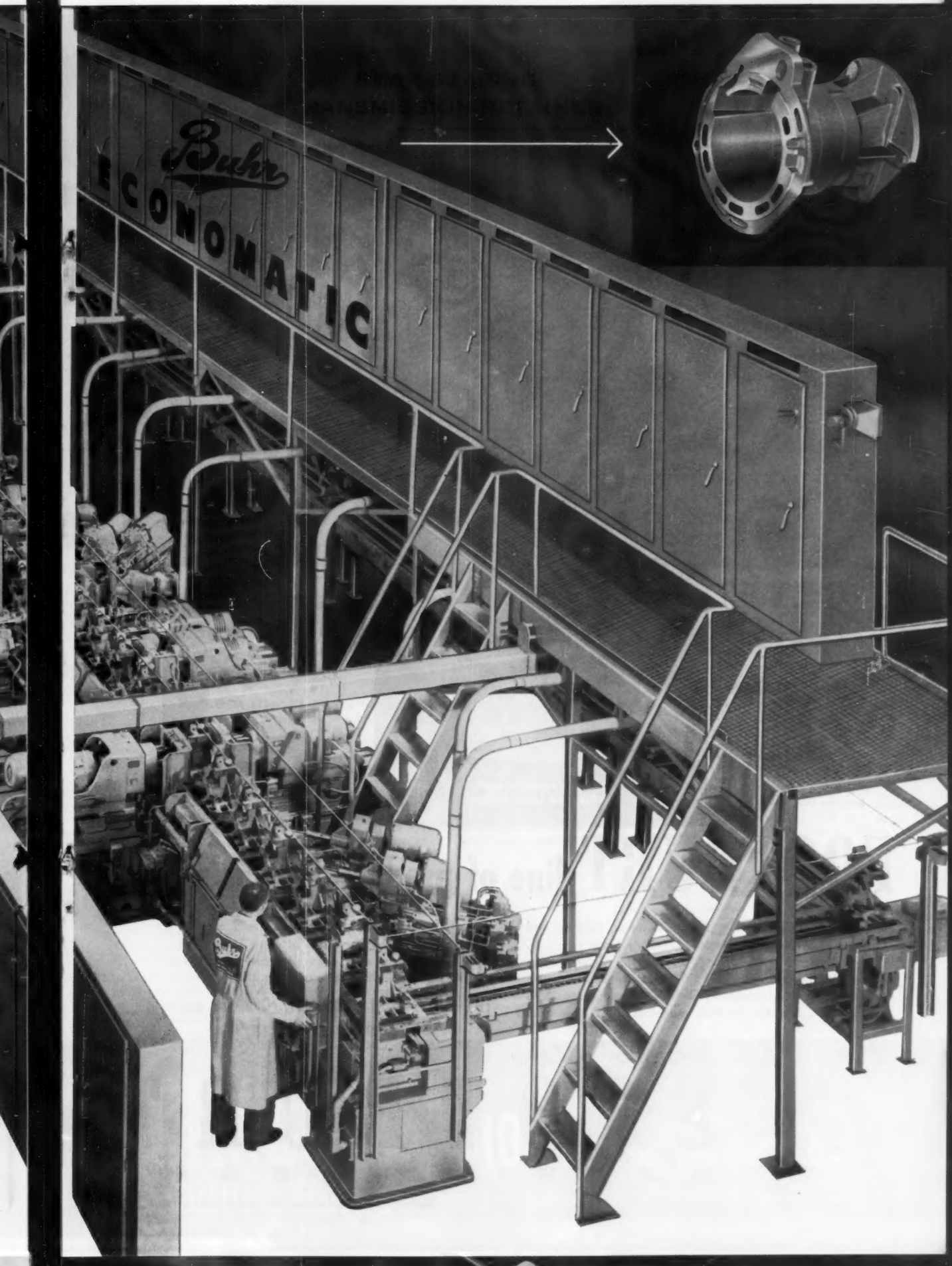
- Elevated electric installations
- Central graphic-control panel
- Exclusive Buhr Detector System in main console to signal and locate electrical failures instantly
- Telephone system with plug-in stations throughout
- Fixtures pressure-cleansed on return
- Distinctive Buhr Sectional-Base Construction to facilitate future part changes
- Central mist-lubrication on all heads
- Automatic lubrication of all moving parts
- Standard and special parts interchangeable for ease of maintenance
- Spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- J.I.C. Standards throughout

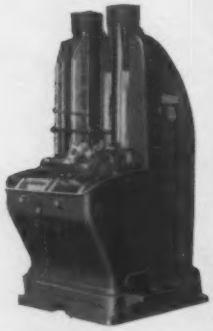
Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

BUHR MACHINE TOOL CO.©

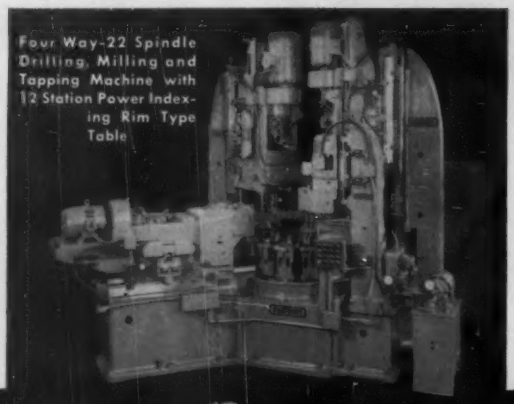
ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers


Buhr
ECONOMATIC



Duplex Surface Broaching Machine
5, 10, 15 and 25 ton capacity

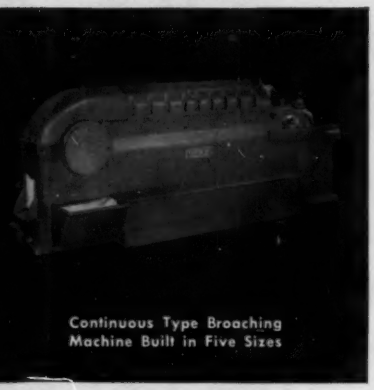


Four Way-22 Spindle Drilling, Milling and Tapping Machine with 12 Station Power Indexing Rim Type Table

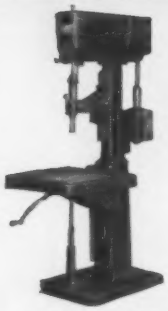
Extremely Accurate Hammond Tool Room Grinder

Single Slide Broaching Machine
5, 10, 15 and 25 Ton capacity

19 Station-115 Spindle
Drilling and Milling Machine

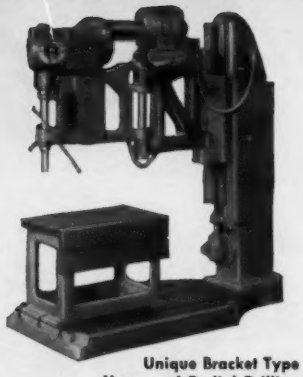


Continuous Type Broaching
Machine Built in Five Sizes



1, 2, 3, 4 and 6 Spindle
Sensitive Drilling Machines

Two-Way Hydraulic Feed
Vee Type Stub Boring Machine



Unique Bracket Type
Hammond Radial Drilling
and Tapping Machine

FOOTBURT line of production machines

• Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sentitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Hammond Surface Grinding Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building

Engineered for production

FOOTBURT

MACHINE TOOLS

For more information fill in page number on Inquiry Card, on page 263

Why CIMCOOL leads the parade . . .

There are three booming reasons why CIMCOOL° is way out in front—actually the largest selling chemical cutting fluid in the world. And each deserves a rousing cheer as they pass in review:

CIMCOOL LOWERS COSTS because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

CIMCOOL DOES A BETTER JOB because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.

CIMCOOL IS CLEAN, doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So join the parade—switch to CIMCOOL, then listen to the sweet music of your machines as they hum with increased production . . . and to the jingle of money saved.

For complete details on all the advantages of CIMCOOL Concentrate, consult your CIMCOOL distributor. He'll be happy to tell you all about CIMCOOL—as well as the entire family of CIMCOOL Cutting Fluids. Or contact us direct and we'll send one of our Cincinnati Milling-trained machinists to call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

fully

The 650 ton double action press shown above incorporates all the advantages of Clearing enclosed design. Operator is shown using the new Clearing Flextrol—a device that lets the operator anchor his operating buttons at the exact spot for most convenient operation on each job.

Automation Limit Switch controls operation of auxiliary feeding devices.

Main control cabinet enclosed behind oil and dust tight doors in the side of the press.

Flush mounted emergency stop buttons are provided at four corners of the press.

Two 110V and two 440V receptacles are provided on the rear of the right hand upright.

Cabinet door handles are recessed for improved safety.

Fully enclosed piping and wiring speed installation, simplify maintenance.

CLEARING PRESSES *THE*

CLEARING MACHINE CORPORATION

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio

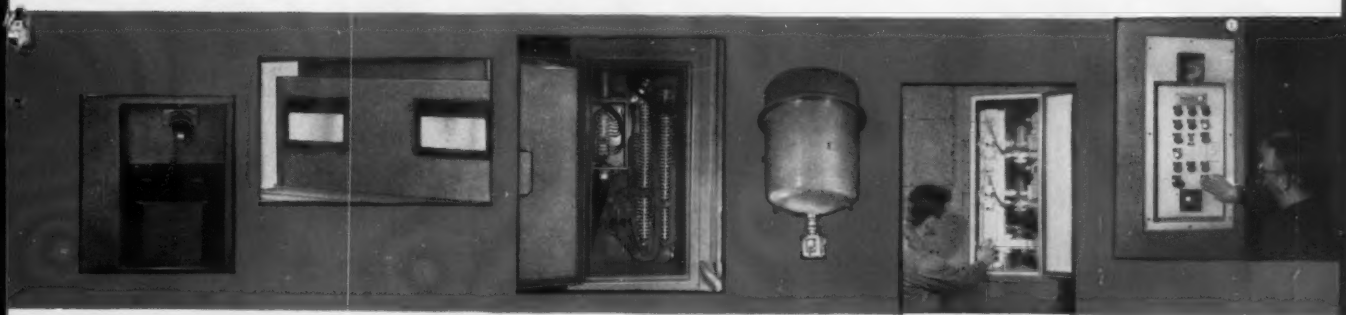
enclosed construction for faster, Automatic Operation— The CLEARING ENCLOSED PRESS

Installation in your plant is a breeze when you order a Clearing enclosed press. Enclosed presses, like the double action floor mounted machine shown on the opposite page, are available in any type of Clearing press from a gap type machine to a 3,000 ton underdrive.

With Clearing enclosed presses electrical and air connections are made about as easily as plugging a lamp into a wall socket. Better use of floor space, simplified feeding and improved material handling conditions are some of the advantages of this press. Improved safety and employee morale are important, too. There are no outboard devices to catch operator's clothing or body or to be damaged by moving trucks or crane loads. Contrast this press with the usual jumble of wiring and the steamfitter's nightmare of piping common to the average press installation. Controls—even the master control cabinet, a bulky six foot box to find space for—are built right into the press uprights. And all wired neatly ready to go!

There are no lamp brackets or air connections to hang onto this press frame. Die space lighting is taken care of by two "walls of light" recessed in the uprights next to the dies. Press Air Manifold and Automation Air Manifold are pre-installed within the press frame.

Below are some of the details of Clearing enclosed press construction. Take a close look at them and if the advanced thinking in design shown here agrees with your conception of what a press ought to be, call on a Clearing sales engineer for more explicit data.



Safety blocks used when setting dies are chained to disconnect plugs which break all control circuits when pulled.

Enclosed die space lights flood die area with even, shadow-free lighting.

Terminal blocks are enclosed at the junction points of crown and uprights to simplify wiring at installation.

Self-contained slide counterbalance cylinders can frequently eliminate surge tanks.

Automation Air Manifold mounted in dust tight enclosure.

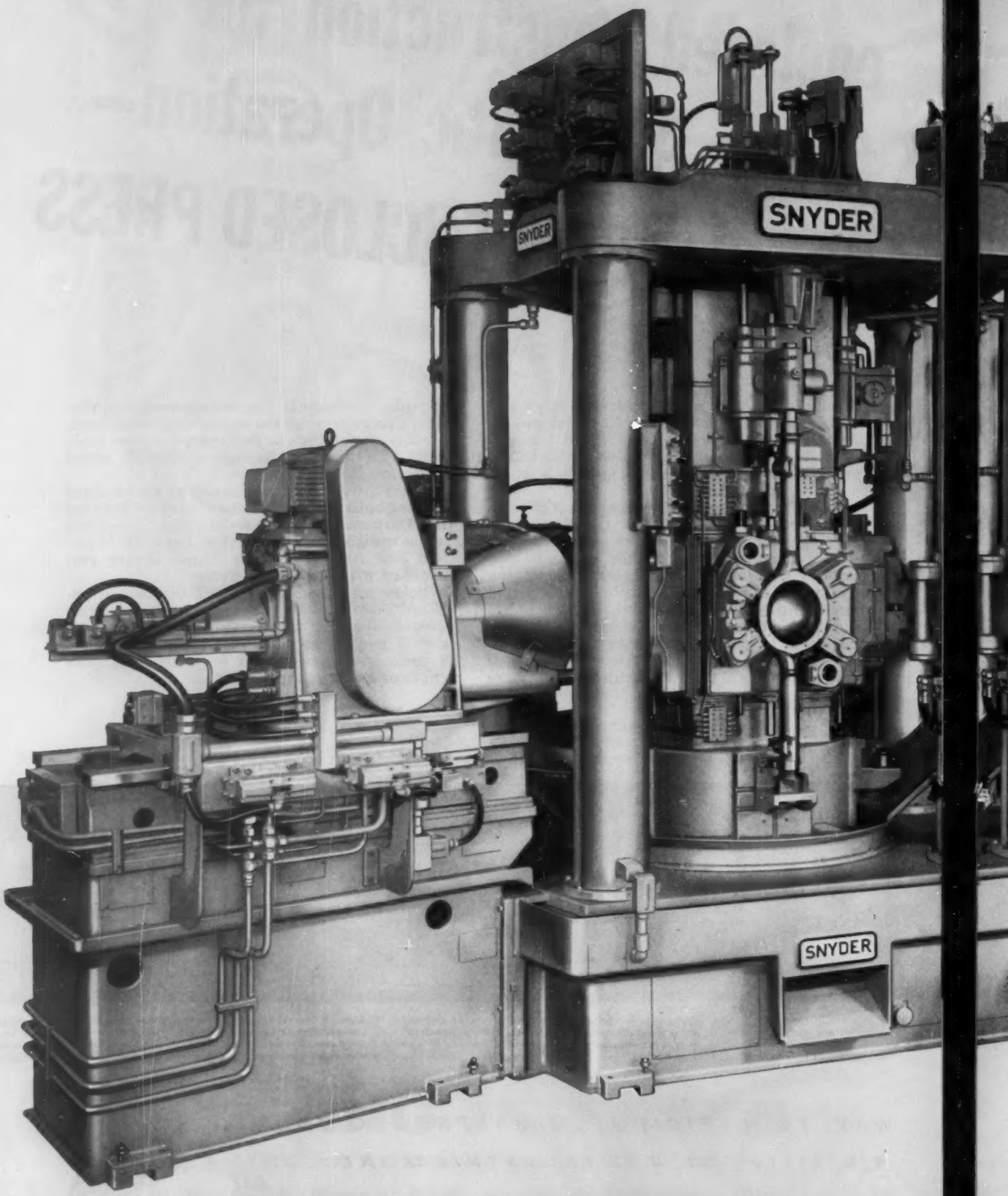
Master control panel is recessed into press upright.

WAY TO EFFICIENT MASS PRODUCTION

● *Division of U.S. INDUSTRIES, INC.*

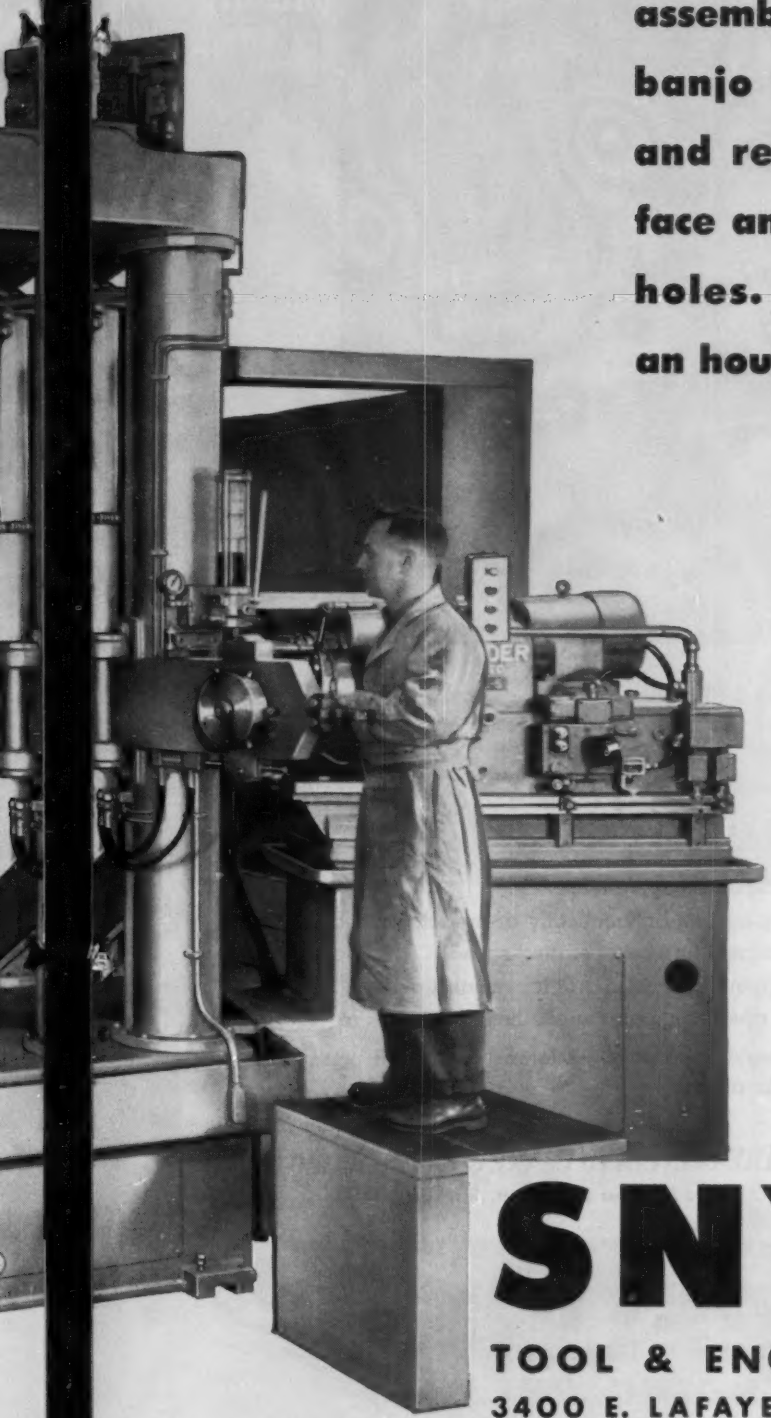
USI

CMC CLEARING


SNYDER
SNYDER
SNYDER

SNYDER VERTICAL TRUNNION MACHINE

for processing rear axle housing assembly; rough and finish faces banjo face, combination drills and reams ten holes in banjo face and chamfers both sides of holes. Production: 105 pieces an hour at 100% efficiency.



SNYDER

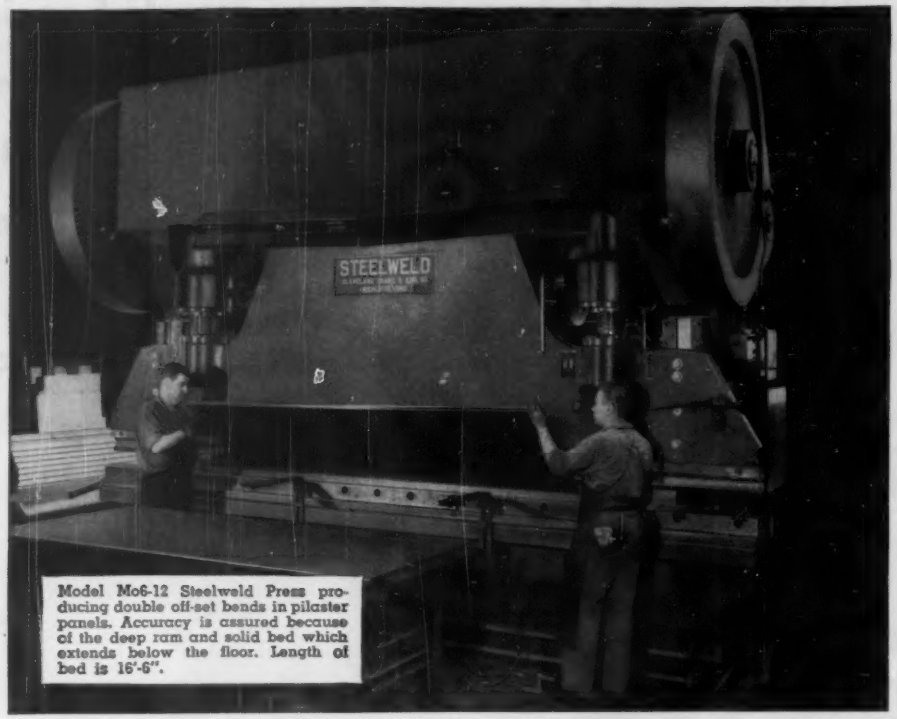
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation

Special Press features

SPEED PRODUCTION



Model Mo6-12 Steelweld Press producing double off-set bends in pilaster panels. Accuracy is assured because of the deep ram and solid bed which extends below the floor. Length of bed is 16'-6".

It takes power to make long sharp bends. It takes size and design to assure accuracy. The Mills Company, Cleveland, Ohio, well-known manufacturers of fine metal partitions achieve both with their big 500 ton capacity Steelweld Press.

But more! They also obtain speed and safety. Their machine is provided with several features that are extremely advantageous:

1. Air-electric control for high production.
2. Electric foot switches for easy fatigueless operation.
3. Ram-positioning selector for stopping ram automatically at pre-selected points.
4. Two speeds, 7 or 21 strokes per minute for best operating speed.
5. Reversing flywheel for quick stopping or reversing of ram at any point.
6. Safety dual control permitting operation only when both operators are ready.

The Mills Company are proud of their modern Steelweld Press. It is the largest of several press brakes in their plant. It is in continuous operation, two shifts a day.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5420 East 281 Street, Wickliffe, Ohio

STEELWELD

BENDING PRESSES

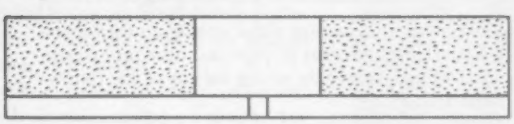
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

For more information fill in page number on Inquiry Card, on page 263

Change to Gardner abrasive increases production per disc 500%

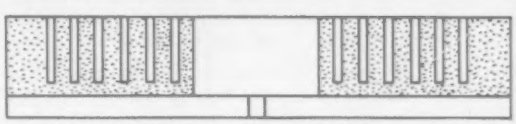
Increase from 55,000 to 300,000 parts per disc... with lower unit grinding cost... due to longer disc life

Former type disc



In flat surfacing operation grinding cast iron flanges, the disc in use required frequent replacement. Longer disc life was sought. The Gardner Abrasives Specialist was called in to study the problem.

Gardner type disc

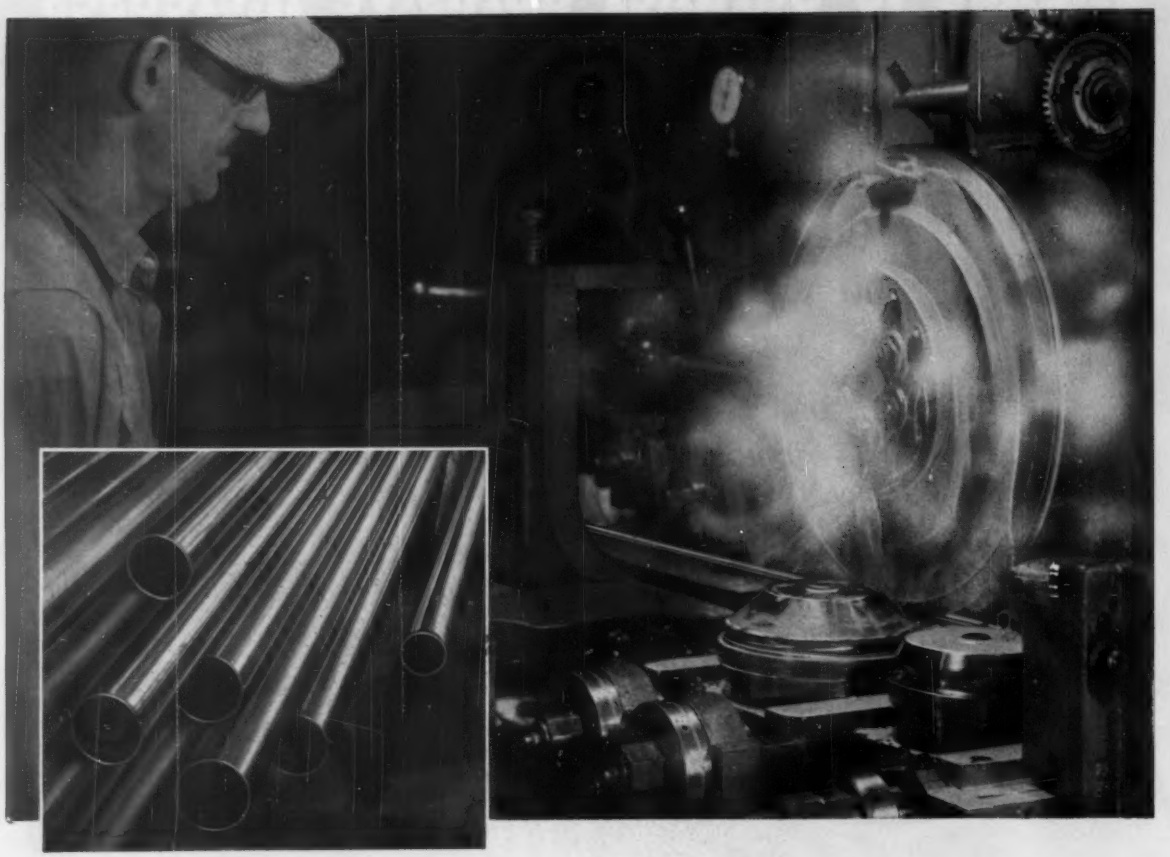


A Gardner combination disc was recommended with smooth outside surface and deep corrugations inside. It withstands heavy stock removal, runs cooler, lasts over five times longer.

GARDNER

abrasive discs

BELOIT, WISCONSIN



IN ELECTRIC-WELD PIPE AND TUBE MAKING

Yoder leads the way

to higher speeds and quality at lower cost

In the short period from 1938 to 1955, the production of electric welded pipe and tubing grew from 269,000 tons to over 3,000,000 tons. This phenomenal rate of growth—over two and one-half times faster than that of the pipe and tube making industry as a whole—to a large extent resulted from a series of important improvements in tube mill design, all introduced by Yoder.

First came the Yoder rotating welding transformer, in 1938. The economic and other benefits conferred by this epoch making innovation were further augmented by other technological advances scored by Yoder in the years that followed. The result was that electric-weld pipe and tube making became the child prodigy of the fast growing pipe and tube making industry.

Latest, and perhaps the greatest, of these developments is the cold forming and induction welding at high speeds of *aluminum, magnesium, brass, nickel, monel, and other non-ferrous metals and alloys.* This process is especially economical for making light and medium gauge tubes in sizes up to 8 in. dia. More and more leading non-ferrous metal producers and fabricators are installing these mills.

More complete information about this and other interesting Yoder developments in pipe and tube mill equipment may be had merely by asking for any of the following publications:

- ☐ Resistance-Weld Mills for making Steel Tubing up to 4" diameter.
- ☐ Induction-Weld Mills for making Non-ferrous Tubing.
- ☐ Resistance-Weld Mills for Steel Pipe up to 24" diameter.

THE YODER COMPANY

5504 Walworth Avenue **Cleveland 2, Ohio**

ENGINEERING YODER MANUFACTURING

PIPE AND TUBE MILLS—Electric Weld

ROTARY SLITTING LINES

COLD ROLL FORMING MACHINES

For more information fill in page number on Inquiry Card, on page 263

CUT TIME, IMPROVE QUALITY

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

TWO "FIRSTS" STRETCH AUTOMATIC TURRET LATHE CAPACITY

Octagonal Turret with JETracer Offers More Work Per Chucking

By taking advantage of two "firsts" in automatic turret lathe accessories, the Edward Valve Division of Rockwell Mfg. Co., East Chicago, Indiana, has increased production of 1½" steel Univalve bodies.

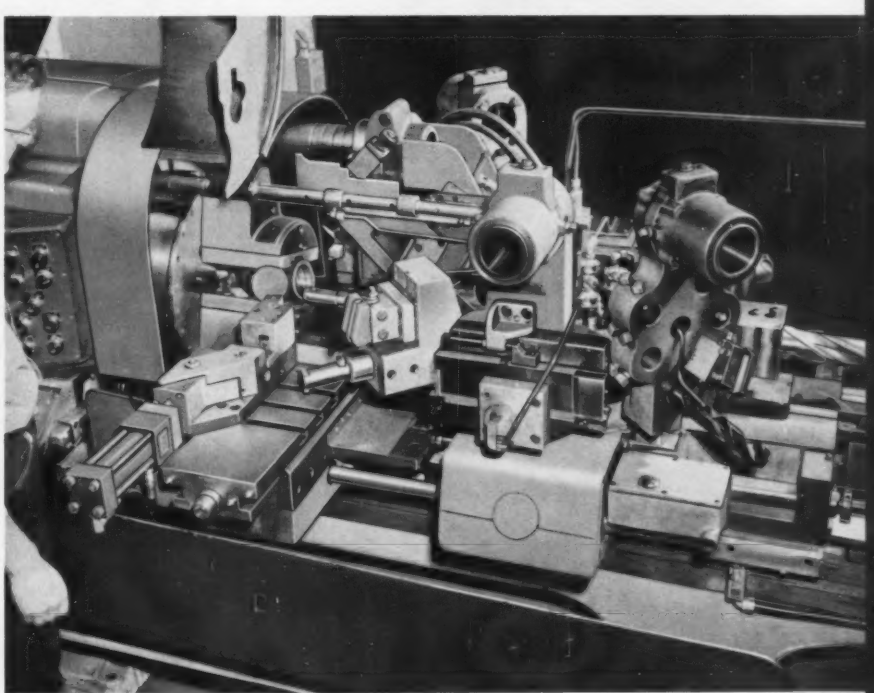
A new MASTERLINE 2F Fastermatic is used. Equipped with an 8-sided turret and a turret-mounted JETracer, a maximum number of surfaces are machined per chucking. Set-up is especially fast and easy. The Fastermatic's toggle switch setup control panel is used to preselect all important machine functions, including low spindle speeds for drilling, forming and threading and high speeds for other operations.

The workpieces are held in an 18" 2-jaw hydraulic operated chuck. Automatic positioning at the end of each cycle speeds loading and unloading. After the automatic cycle is started, hexagon turret tools drill, turn, face, form, relieve, chamfer, bore and thread, in addition to facing and chamfering performed from the two cross slides. The turret-mounted JETracer operates within the cycle to maintain high accuracy on the difficult internal machining operations.

The first operation is shown. The part is machined from the solid in 8.5 minutes floor-to-floor time. After the lot is completed, tools are adjusted on 4 hexagon turret stations and the part is completed, including generating the seat angle with the JETracer, in 2.8 minutes floor-to-floor.

Greater accuracy, finer finish and consistent quality are provided by completing maximum number of surfaces in a single chucking and using the JETracer.

Workpiece, showing multiple diameters accurately machined in two fast automatic operations.



Close-up of tooling. Note octagon turret mounting the JETracer unit, which is actuated by second overhead stop bar eliminating interference with overhead-piloted turret tools.

WITH THE GISHOLT MASTERLINE

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

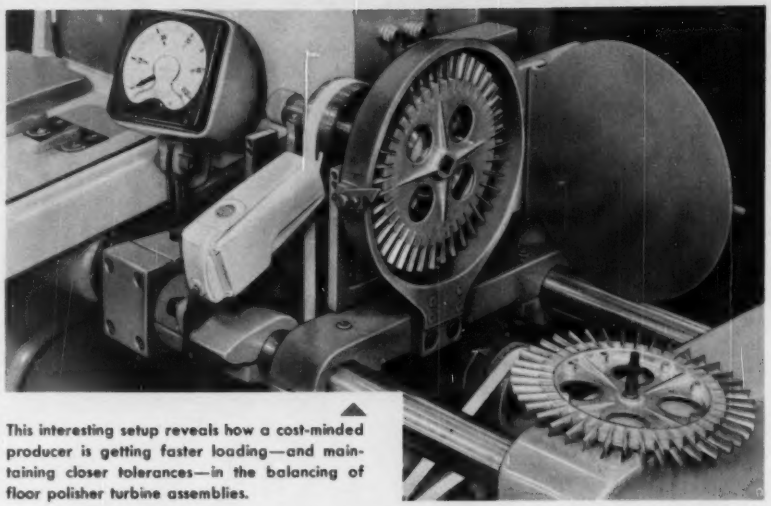
BALANCING IN OVERHANG SIMPLIFIES HANDLING

Gisholt 1S with Special Arbor Makes Impeller Balancing Precision, High-Speed Operation

With this arrangement, the producer is balancing floor polisher turbine assemblies outside the work supports eliminating the work of belt-shifting and arbor-handling.

The machine used is the Gisholt Type 1S balancer, equipped with a special arbor which is not removed from the work supports. A hinged shroud reduces air-turbulence and protects the operator. Because the part has large diameter compared to width, only single-plane force unbalance is measured.

The Direct Reading Amount Meter is calibrated to make one unit equal $\frac{1}{32}$″ drill depth of a $\frac{3}{16}$″ drill at the correction radius. The operator simply looks at the meter, marks the angle, removes the part and corrects it on a nearby drill press using a $\frac{1}{32}$″ depth scale to speed the operation.



This interesting setup reveals how a cost-minded producer is getting faster loading—and maintaining closer tolerances—in the balancing of floor polisher turbine assemblies.

One operator locates, measures and corrects 25 assemblies per hour with this setup. Balancing in the overhang drastically reduces workpiece handling while maintaining high accuracy.

250% PRODUCTION INCREASE WITH THIS SETUP

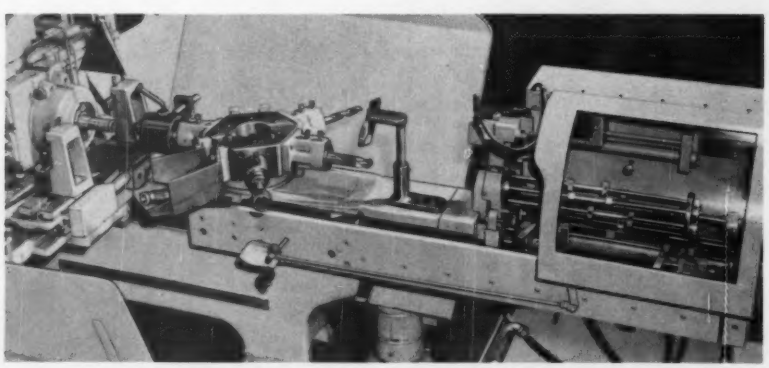
Hydraulic Drive Converts Hand-Operated Lathe to Fully Automatic Operation

You'll be impressed with how this manufacturer has accomplished full automation on small job-lot production runs. The workpieces are steel adjusting screws, produced from bar stock in a variety of sizes.

Here's how it's done on a screw $3\frac{1}{8}$″ long with $1\frac{11}{16}$″ diameter—automatically controlling all operations and machine functions with the Lynn Hydraulic Drive Unit mounted on the rear of the Gisholt Ram Type Turret Lathe. Fed pneumatically against a turret stop and chucked, the stock is start-drilled, then finish-bored with a large drill. The Hydraulic Drive automatically backs the drill out to clear the chips, then rapid traverses back to where it left off before dropping into feed to continue drilling. Spindle speed automatically decreases as tools on the front cross slide form the O.D.—drops into a lower speed as the O.D. is threaded—and into another low speed as radii are formed on the finished part and on the end of the bar stock. A tool on the rear cross slide cuts off the finished part, which drops into a basket mounted on the hexagon turret for easy removal by the operator.

Former f.t.f. time with the hand-operated machine on this job was 8.1 minutes—now cut to only 3.25 minutes floor-to-floor by the Lynn Hydraulic Drive, with no additional setup time required.

This setup increased production, eliminated human error, and provided automatic operation for existing equipment at the lowest possible cost per unit.



Finished workpiece, completely machined from bar stock in one fast, automatic operation. Class 3 threads are no problem with the Lynn Hydraulic Drive arrangement.

Hydraulic drive unit (right) and pneumatic bar feed provide complete automatic operation for hand-operated turret lathe. Note special cam plate on rear of turret ram to close die head as turret indexes.

GISHOLT

TIME-SAVING IDEAS

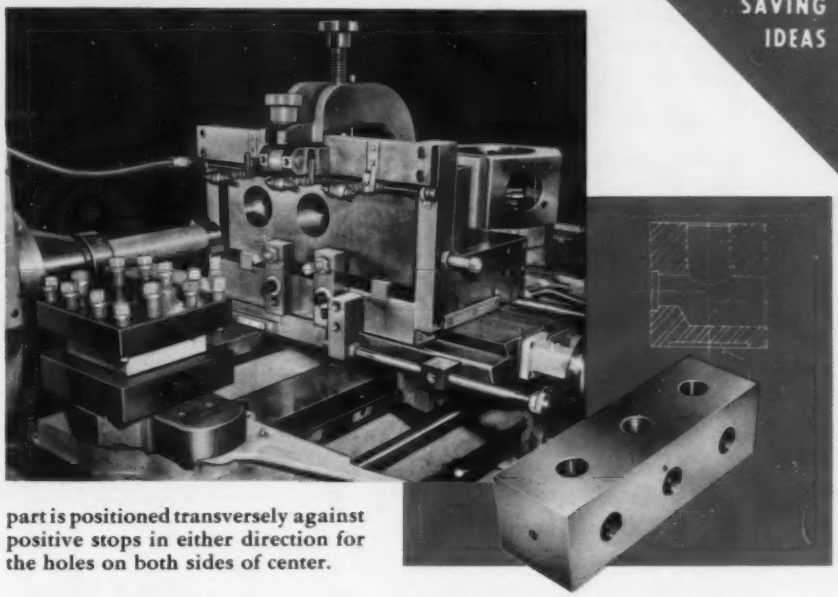
TWO MACHINES FOR THE PRICE OF ONE

Fixture Converts Standard Turret Lathe for Precision Boring Operations

Here's how Ajax Iron Works, Corry, Pa., saved the cost of a special purpose machine through smart tooling on a standard Gisholt 3L Saddle Type Turret Lathe.

The workpieces are tough steel cylinder blocks for Triplex Pressure Pumps used in oil well reclamation projects. Made in small lots in various sizes, their production could not justify a special purpose machine. Also important, the many other jobs to be performed, required a rugged saddle type turret lathe.

Ajax solved the problem with a special fixture to hold the workpiece during machining. This fixture is mounted on a bridge-type cross slide base, with a manually operated handwheel providing transverse movement. The base is attached to the hexagon turret to receive longitudinal movement. To begin machining, the block is located against a positive stop on one end and clamped on the other. For the remaining three faces, a centering plug is used in the center hole of the previously machined face for accurate location. The part is positioned transversely against positive stops in either direction for the holes on both sides of center.



Special fixture holds close tolerances easily, and when not in use is easily removed to use lathe for conventional machining operations on other parts.

Cylinder block is securely held in special fixture. Note tool mounted on spindle nose quick-change tool holder and adjustable transverse stops at lower right. All four faces are machined as per cross sectional drawing.

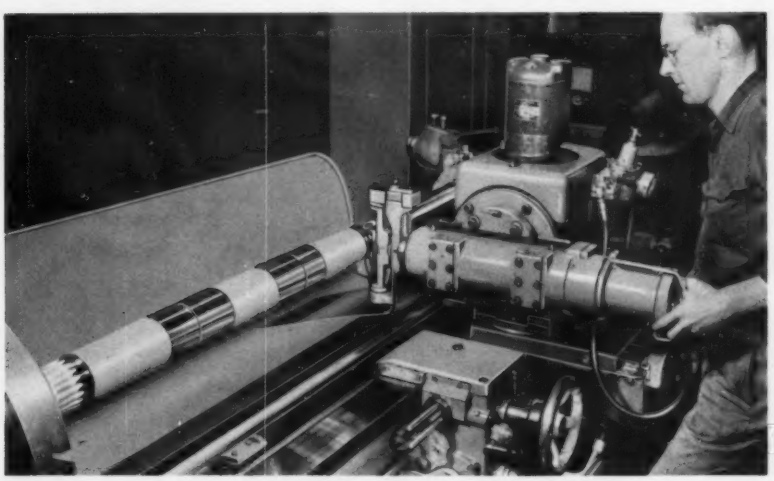
ATTACHMENT ON LATHE CUTS COSTS ON SHORT RUNS

No. 4 Superfinisher Provides Required Finish in Minimum Time, Saves Machine Investment

Here's how a cost-wise manufacturer is handling one-piece jobs on short runs not justifying the extra expense of a large machine.

The workpiece—a steel axle used on one of today's modern commercial aircraft—is of 50-53 Rockwell C hardness. To provide the fine finish and long wear life required for several surfaces, the manufacturer is Superfinishing the axles to a high degree with a No. 4 Superfinishing Attachment mounted on a turret lathe.

In addition to obtaining the 3-4 micro-inch surface finish desired, the part is also sized on this job. A slow spindle speed combines with a fast traverse and fast oscillation rate for the roughing operation, and a fast spindle speed is used with a slow oscillation and traverse rate to finish each bearing surface. By removing amorphous "smear" metal, the Gisholt Superfinishing process assures longer, safer wear-life on the axles' most critical areas.



Use of Superfinishing attachment utilizes existing machine, improves product performance and quality.

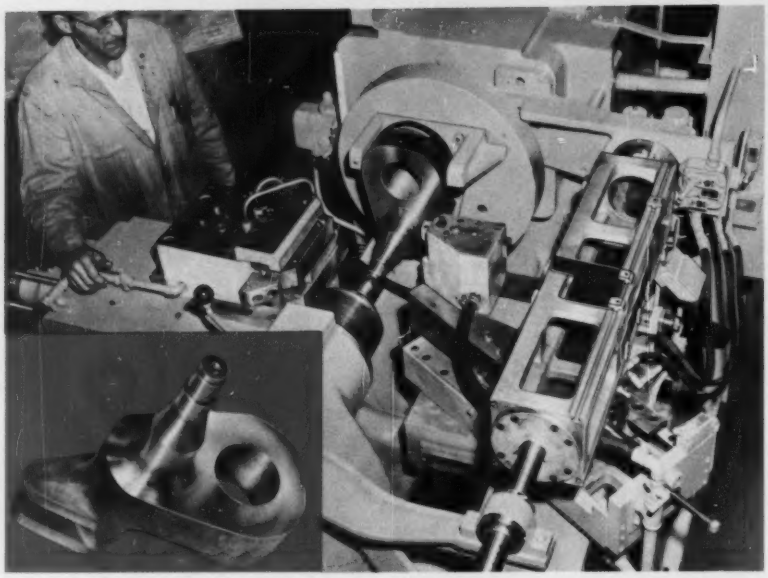
Close-up of operation, showing Gisholt No. 4 Attachment used to Superfinish 6 diameters on commercial aircraft axle.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

WHIPS PROBLEM PART WITH RIGHT EQUIPMENT

Tough, Interrupted Cut and Contour Machining Easily Handled by No. 24 with Gisholt JETracer



Workpiece supported between centers using special fixture to locate and drive. Note JETracer on rear slide, with stylus at rear of cam roll. Different templates on each face are for different lengths of cut.

You'll like the way this producer is turning out steel tank idler arm forgings with the powerful No. 24 Automatic Production Lathe. Special equipment includes a JETracer on the rear independent slide, plus a 2-speed motor arrangement to provide correct machining speeds when facing and turning.

The part is held between centers, with a special face plate fixture locating the work and driving against the large O.D. radius. All cuts are made separately, with each slide performing a rough and finish pass. The front tool slide faces at 60 rpm and .015″ feed (306 fpm), and has automatic tool relief. Two tools divide the length of cut to shorten machining time. A special step-over cam arrangement repositions the front carriage and its tools for the finish pass. The JETracer—controlling the rear slide which turns all diameters on the idler arm at 180 rpm and .015″ feed (259 fpm)—uses a 4-position indexing cam roll permitting up to 4 automatic passes if needed. Floor-to-floor time on the 18″ long, 5½″ major radius part shown is just 21.1 minutes.

JETracer provides maximum accuracy with minimum operator effort; is easily set up for other workpiece sizes.

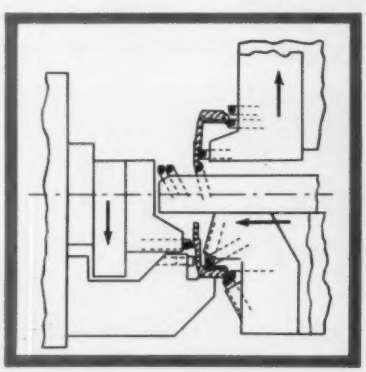
MACHINES ALUMINUM AND CAST IRON SIMULTANEOUSLY

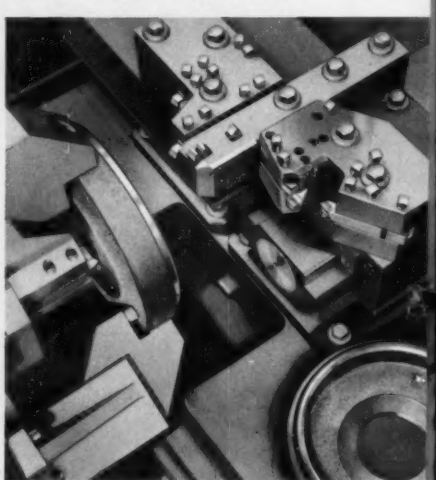
Completes Part in Single Chucking with Back-Facing Attachment on Simplimatic

Every second pays off in this job. In one chucking on a Simplimatic Automatic Lathe, the manufacturer is handling brake drums 11¾″ in diameter and 2½″ deep—machining the aluminum shell and cast iron braking surface insert at the same time and getting a fine finish on both.

The conventional air chuck could not be used, because the spindle bore had to be cleared for mounting a back-facing attachment. A power chuck wrench operates the scroll chuck, gripping the work on the O.D., locating against the back of the part. The back-facing attachment does the back side of the web, while tools on the two front slides handle all surfaces indicated on the layout.

Eleven tools machine 10 surfaces in just 2.4 minutes f.t.f. time, with minor adjustments handling either front or rear brake drums.





Close-up showing workpiece in chuck, back-facing attachment at left center and slide tooling. Note rigid support for all tools.

9-1056
667

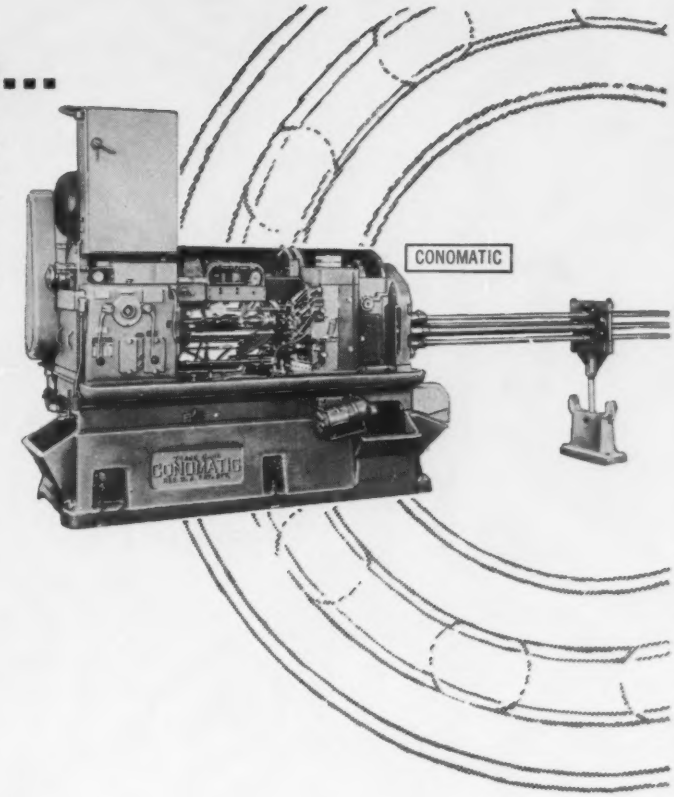
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

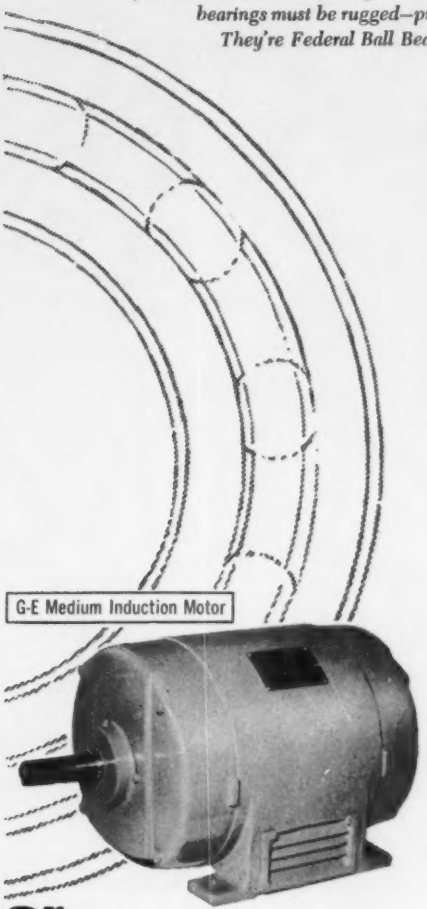
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

to feed a tool...

Automatic feed transmissions on newest type Conomatic Six Spindle Bar Machines have to deliver a powerful, steady tool drive under heavy loads for precision carbide machining. Feed shaft bearings must be rugged—precise. They're Federal Ball Bearings.





or quiet a motor...

The smooth hum of today's precision-built motors whispers the efficiency of every part. Here, too, Federal Ball Bearings quietly perform their continuous, anti-friction assignment—whatever the size—whatever the type.

so much of industry *turns* on FEDERAL ball bearings

Machine tools—motors—or moving vans! At plant, home, machine shop! On the highway, on the farm—where there's anti-friction work to be done, you'll find Federal Ball Bearings quietly and efficiently on the job. Hundreds of types—12,000 sizes—produced by this 50-year-old manufacturer of ball bearings...exclusively.
When Federal Ball Bearings are a part of so many things you *use*, shouldn't they be a part of the things you *make?*

Just off the presses! *175 pages of ball bearing and engineering data*—FEDERAL'S NEW CATALOG! *Just drop us a line and we'll speed you your copy.*

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, N. Y.

Federal BALL BEARINGS

One of America's Largest Ball Bearing Manufacturers

For more information fill in page number on Inquiry Card, on page 263

It's not always possible to launder *all* the chips or filings out of ordinary wiping material. Chips come back to scar men and metal, to plague your production line. This man has already had four wiper cuts.

He had 4 wiper cuts last month

They're easy to distribute . . .

They really soak up oil . . .

Always a clean one handy . . .

Just toss 'em in the trash . . .

Chips can't hide in a clean Scott Wiper. Each Wiper is brand new, fresh from the carton. A man takes a Scott Wiper as he needs it . . . uses it for his face, his hands, his product.

. . . He had none!

The difference is . . . Scott Wipers

This is sanitary wiping. A man uses a Scott Wiper thoroughly, throws it away—takes a new one. No danger of cuts from hidden chips . . . no fear of skin infection from dirty wipers . . . when you take a fresh wiper from the carton.

And because Scott Wipers are disposable you save in many other ways. Sorting and baling are eliminated. Handling and distribution are simplified. Laundering becomes a thing of the past.

Your local Scott representative or distributor is ready to demonstrate in your plant any time you say. Call him or mail this coupon right away.

Another quality product of . . .

SCOTT PAPER COMPANY

Scott Paper Company
Dept. W-5, Chester, Pa.

Please send me more information about Scott "Throw Away" Wipers.

Name_____

Company_____

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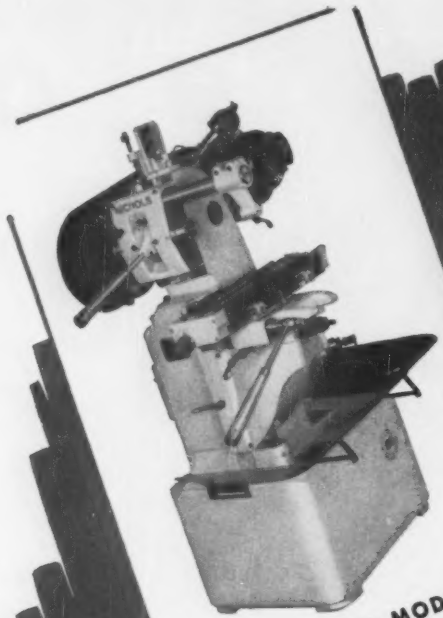
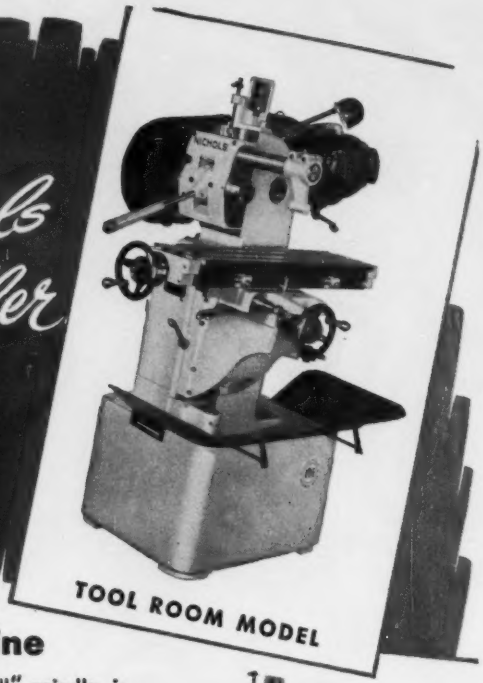
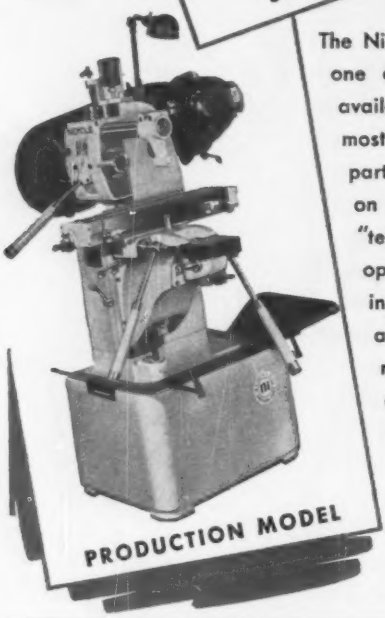
Nichols Miller





. . . a complete line

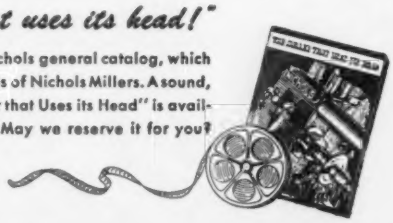
The Nichols Miller, with "rise-and-fall" spindle, is one of the most precise, universal machines available today. The four models shown, fill most basic requirements—whether for single parts with simple set-up, or multiple operations on mass production jobs with tolerances to "tenths". Their versatility makes possible such operations as facing, boring, recessing, turning, slotting, key seating and contour milling, as well as regular milling. According to requirements, screw or lever longitudinal and transverse table feeds are available optionally. "The miller that uses its head" is your best choice—and one of industry's greatest values. If you want production to "tenths", investigate the Nichols Miller.



ni

"the miller that uses its head!"

Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie "the Miller that Uses its Head" is available for free showing. May we reserve it for you?



CONDENSED SPECIFICATIONS

Table Working Surface	6¾" x 21" or 30"
Longitudinal Travel (screw or lever)	10" or 19"
Transverse Travel (screw or lever)	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-E MAMARONECK AVE. WHITE PLAINS, N. Y.

For more information fill in page number on Inquiry Card, on page 263

Announcing...

44 ALUNDUM*

A sensational new concept in abrasive manufacture and performance

by NORTON ABRASIVES

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

MEET the New...

44 ALUNDUM abrasive

...a revolutionary Norton development for new "TOUCH of GOLD" economy in a wide range of grinding jobs

You Can SEE The Difference! The new Norton 44 ALUNDUM abrasive (right in illustration) differs radically in appearance from ordinary aluminum oxide abrasive as you can see from the 2 pieces shown here. The finer grain structure of "44" indicates its much denser, tougher composition. And the money-saving performance of this modern new abrasive is just as easy to spot — every time 44 ALUNDUM wheels go to work for you.

In new 44 ALUNDUM abrasive Norton brings you a combination of grinding quality, versatility and economy that has never before been equalled in a non-premium abrasive.

We want to emphasize that point. Although 44 ALUNDUM is non-premium priced, right there its resemblance to any regular aluminum oxide abrasive ends abruptly. It is definitely different and better in every way.

"44" is made differently, by a special, Norton-developed, electric furnace process that results in extreme toughness and ruggedness. This makes "44" the top performer for heavy duty grinding.

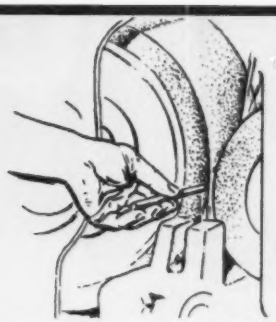
"44" performs differently. Compared to other non-premium priced aluminum oxide abrasive wheels, the new 44 ALUNDUM wheels cut faster, grind cooler and last longer. They hold form better, finish better and give more pieces per dressing. These are your "Touch of Gold" advantages that improve product quality, while reducing grinding time and costs.

"44" does more jobs. While not a cure-all, this new abrasive is a topnotch performer in widely varying types of grinding. For example:

PRECISION GRINDING	ROUGH GRINDING
CENTERLESS	SNAGGING
INTERNAL	WELD GRINDING
CYLINDRICAL	BILLET GRINDING
THREAD GRINDING	DISC GRINDING

MOUNTED WHEELS

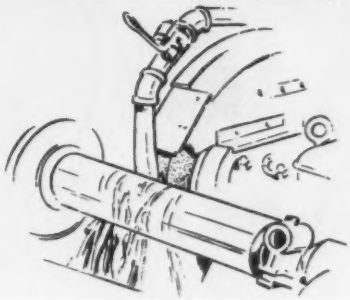
Proved In 1100 Tests. Before being offered to industry, 44 ALUNDUM wheels had the thorough testing given to every new Norton product. Over 1100 different tests were made — throughout the country and across "44's" entire job range. Here are some typical test reports:



CENTERLESS GRINDING

Job: Steel bushings. *Report:* "Faster cut, longer life and better finish."

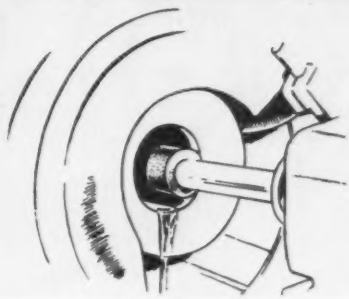
Job: Miscellaneous parts. *Report:* "44 ALUNDUM wheels much more versatile for different materials and set-ups. Time cut on one 14-hour job to 10 hours."



CYLINDRICAL GRINDING

Job: High speed steel dies. *Report:* "More pieces per dressing, cooler cutting, 30% longer life. Best wheel ever used."

Job: Miscellaneous steel parts. *Report:* "10% more pieces per dressing and 10% longer wheel life."



INTERNAL GRINDING

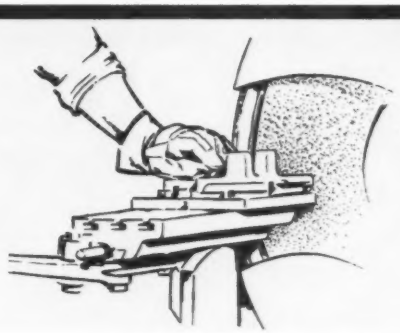
Job: Heavy duty hardened steel bushings. *Report:* "Even breakdown with excellent cutting action and less glazing. Half the dressings required with previous wheel."

Job: Steel gear housings. *Report:* "44 ALUNDUM wheels freer cutting, hold form better with less dressing and improved finish."

SNAGGING

Job: Offhand snagging, welded iron sections. *Report:* "80% longer wheel life and much faster cut."

Job: Offhand grinding steel parts. *Report:* "Faster cutting, better finish, much less burn."



DISC GRINDING

Job: Coil springs. *Report:* "Production increased from 100,000 to 125,000 springs."

Job: Stainless steel castings. *Report:* "Freer cutting, less burr and longer disc life."

MOUNTED WHEELS

Job: Snagging cast steel. *Report:* "Faster cut and 30% longer wheel life."

Job: Deburring steel welds and stampings. *Report:* "Four times longer lasting, with equal rate of cut."

Adding Up

Anything you can grind with non-premium priced aluminum oxide abrasive you can grind with 44 ALUNDUM abrasive — in every case at least equally well, in most cases a great deal better.

And you can do *more* jobs with tough, versatile "44". A real workhorse abrasive, it delivers thoroughbred performance that means more and better grinding for less money.

44 ALUNDUM wheels are available in all the popular Norton bonds. Already these new wheels are solving a lot of grinding problems, for a lot of users. How about letting them tackle yours — right now?

See Your Norton Distributor for further facts. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

On preceding pages you've read the benefit story of a great new Norton product. Here is . . .

The service story behind the new 44 ALUNDUM abrasive

"NORTON CITY"—ABRASIVE CAPITAL OF THE WORLD, contains over a mile of buildings, housing the most modern equipment ever devised for producing grinding wheels and other abrasive products. Here, too, 180 technicians in 19 specialized laboratories maintain Norton's long leadership in research and development. From this leading source of abrasive progress have come many news-making "firsts" — to which new 44 ALUNDUM abrasive is the latest addition.

COMPLETE STOCKS, STRATEGICALLY LOCATED. Gigantic stockrooms in the Worcester plant hold products totalling over 500,000 different grinding combinations. Norton warehouses are located in important industrial centers. Both the Worcester stockrooms and the regional warehouses carry generous supplies of the new 44 ALUNDUM wheels. And your Norton Distributor is careful to keep his own stocks — including 44 ALUNDUM wheels — fully adequate to the needs of his area.

Your Norton Distributor, one of over 315 in the United States alone, is your direct connecting link with the largest, most efficient service and supply system in the entire abrasive field. He can serve you in many important ways. For example:

- *The world's broadest line of abrasive products to choose from.*
- *Practical aid in any grinding problem. And for unusual problems he can always call in a Norton Abrasives Engineer.*
- *Prompt deliveries—and emergency deliveries to help you avoid costly shut-downs.*

Ask him for details on how the new 44 ALUNDUM wheels can bring you the product-improving, profit-boosting "Touch of Gold". Or write your nearest Norton district office.

NORTON
ABRASIVES

Making better products... to make your products better

W-1735
8-56

WADELL FEATURES

A COMPLETE HIGH PRECISION BORING MACHINE FOR $4760.*

AUTOMATIC CYCLE

The purely mechanical movement of the table, including rapid approach, feed, dwell and rapid return is controlled by a simple plate cam. Pick off change gears allow regulation of the feed rate. The cam shaft has extra positions for synchronizing an index table and, or automatic holding means.

SAVES FLOOR SPACE

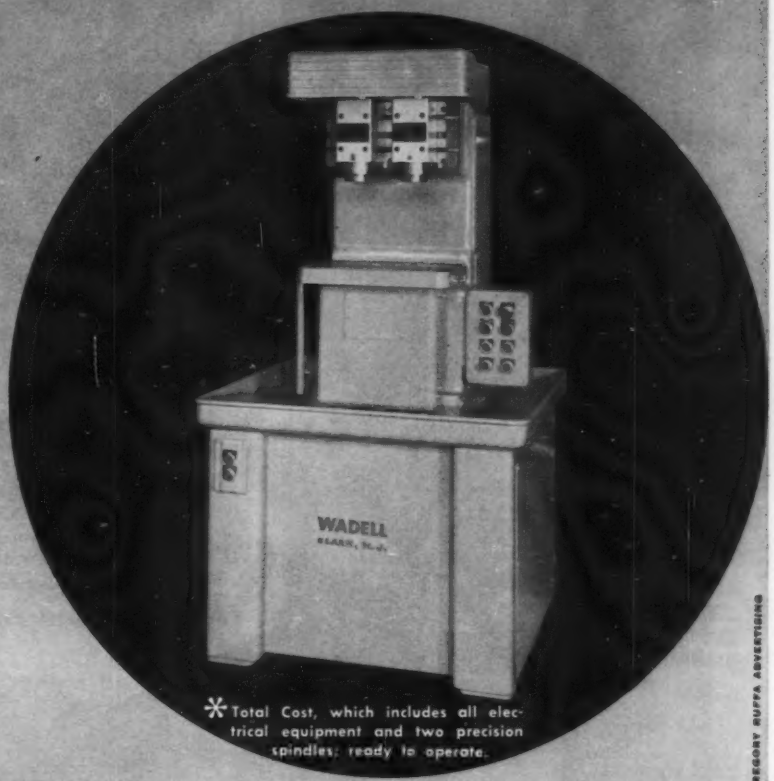
Vertical, compact design requires only 2½ ft. x 3 ft. of valuable floor space.

SUPER PRECISION

Wadell modern facilities and craftsmanship assures extreme accuracy. All moving parts are electronically balanced to the highest standards.

HIGH PRODUCTION

The Wadell tenth accuracy index table provides high production potential. Chute loading and other automatic loading set-ups are readily adaptable.



*Total Cost, which includes all electrical equipment and two precision spindles; ready to operate.

GREGORY RUFFA ADVERTISING

Typical tooled set-up with Automatic Indexing Table

EQUIPMENT COMPANY

TERMINAL AVENUE • CLARK, NEW JERSEY

for further information contact the dealer nearest you

Atlanta, Ga., Allison Machinery Co.; Buffalo-Rochester, N.Y., G. W. Brunton & Son, Inc.; Chicago, Ill., Milwaukee, Wis., Minneapolis, Minn., Bryant Machinery & Engineering Co.; Boston, Mass., General Machinery Corp.; New Haven, Conn., New York, N. Y., Giebel, Inc.; Philadelphia, Pa., Lemuel R. Lance Co.; Grand Rapids, Mich., Joseph Monahan Co.; Indianapolis, Ind., Toledo, O., Oatis Machinery Co.; Portland, Ore., Portland Machinery Co.; Los Angeles, Cal., Seaboard Machinery; Dayton-Columbus-Cincinnati, O., The Seifreat-Elstad Machinery Co.; San Francisco, Cal., M. A. Sherritt Co.; Syracuse, N. Y., H. A. Smith Co., Cleveland, O., Pittsburgh, Pa., Wm. K. Stamets Co., Detroit, Mich., Chas. A. Strelinger Co.; Scottsdale, Ariz., Wilson Machinery Corp.; Montreal, Toronto, Quebec, Windsor, Ottawa, Canada, Williams & Wilson, Ltd.

For more information fill in page number on Inquiry Card, on page 263

GOLD N RING

Units are available in flush-plate or enclosed mountings, and are adaptable for special panel assemblies.

New...

Oil-tight • Water-tight • Dust-tight

Protected against oil and water seepage by Sealtight oil-resistant rubber diaphragm. Rated for 600 volts, AC or DC. Meets requirements of Joint Industry Committee and National Machine Tool Builders' Association.

EASILY REPLACES EXISTING SWITCHES — Designed for mounting in $1\frac{13}{64}$" diameter holes on standard panel mounting centers, this switch easily replaces existing switches. Accommodates panel thicknesses of $\frac{1}{16}$" to $\frac{1}{4}$" in $\frac{1}{32}$" increments. Full interchangeability of units and their components permits ready adaptation to multiple assemblies.

Another product of...

National Acme

Sealtight CONTROL SWITCH

Made by machine tool builders to machine tool specifications

How often have you, when designing a machine tool, wished for a control station unit designed and constructed *"as a machine tool builder would build it."*

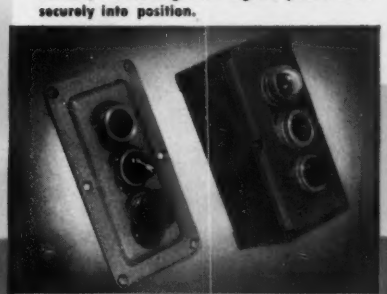
If you have been so handicapped in the past, you'll want to take a good close look at the NEW Namco GOLD-N-RING Control Station Switch Unit. Built by National Acme, builder of the world's only complete line of bar and chucking automatics, it is the *only* switch made *by* a machine tool builder *with machine tool know-how behind it.*

- **It is a heavy-duty switch in every respect.**
- **It is oil-tight, water-tight, dust-tight.**
- **Heavy-duty silver-alloy contact points provide maximum electrical capacity and long life**
- **Heavy-duty terminal screws, with 3/8" thread contact, prevent stripping during installation and permanently secure wires for continuous trouble-free service.**
- **None easier to install; none more fool-proof.**

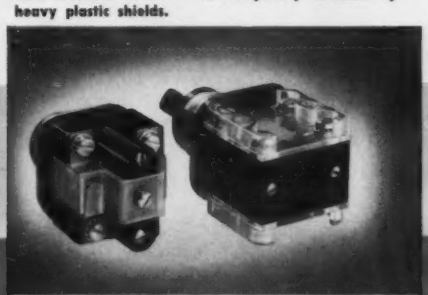
For complete details, send for Bulletin ECS-56. Better yet, ask for a representative to bring a switch for your examination.

Electrical Mfg. Division • THE NATIONAL ACME COMPANY • Cleveland 8, Ohio

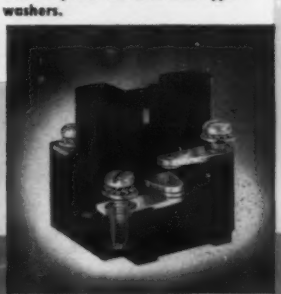
▼ **FLUSH PLATES OR ENCLOSURES** accommodate any combination of individual push button, selector or pilot light assemblies. Box covers and flush plates are provided with captive screws to facilitate installation. Easy-to-read, interchangeable legend plates lock securely into position.



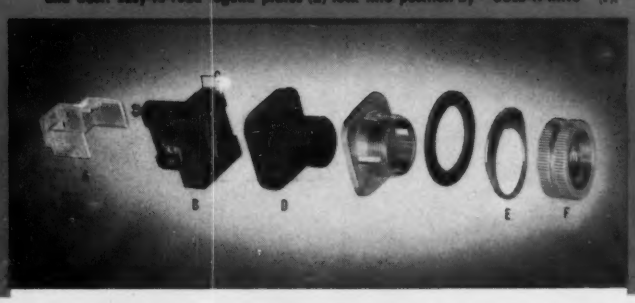
▼ **SINGLE AND DOUBLE POLE CONTACT BLOCKS** can be used interchangeably with the several types of GOLD-N-RING push button and selector operator heads. Design provides easy access for secure wiring (or use of stake-on lugs) without interference. Fixed and movable contacts are completely enclosed by heavy plastic shields.



▼ **BRASS INSERTS** molded in block permanently hold stationary contacts. They also provide more thread support for the No. 8-32 terminal screws that are equipped with captive flat and lock type washers.



▼ **BUILT AS A MACHINE TOOL BUILDER WOULD BUILD IT!** Plastic shields (A) completely enclose contacts. Main block (B) is unit-molded to assure alignment and simplify assembly. Fully guided plunger (C) of cross-head design, prevents binding. Oil-resistant rubber diaphragm in operator head (D) completely seals out oil, water and dust. Easy-to-read legend plates (E) lock into position by "GOLD-N-RING" (F).



▼ **INTERCHANGEABLE "GOLD-N-RING" COLLARS** come in 3 different heights. Buttons can be made either extended or flush type merely by changing collar. Buttons are of non-fading glass-filled polyester and come in an assortment of colors to conform with standard codes.

don't lose a day...
E 4½
75 TON
THE HOTTEST O.B.I.

without the spectacular facts

TOTALLY ENCLOSED . . .
BRAND NEW FROM THE GROUND UP

- Rugged, front-to-back crankshaft with huge crankpin
- Fully concealed, yet accessible, driving mechanism
- Enclosed, rigidly supported gearing operates in sealed oil bath
- Electro-pneumatic friction clutch on crankshaft
- Wider spaced, longer, narrower gibs
- Wider, box type slide all within gibbing
- Precision, hardened, longer-wearing gears
- Compact, straight-line, space-saving, all-steel frame

This is it! The most talked about press in the world! The press that captured the hearts of the entire industry at the Machine Tool Show! The press that was born to do more than any O.B.I. ever built!

Get the spectacular facts and figures on this metalworking marvel . . . the all-new Niagara Series E, Front-to-Back Crankshaft Inclinable. It outmodes everything within its range (75 to 200-ton capacities, 4 ½ to 7 ½ inch shaft diameters, standard and automated models).

PRESS IN HISTORY!

STUDDED WITH SCORES OF TECHNICAL IMPROVEMENTS

- No overhanging gears, flywheel and other mechanisms
- No damaging crankshaft deflection
- Full support to wide dies — no overhang on slide
- Greater resistance to off-center loading
- Accurate alignment of slide, with minimized tendency to cock
- Substantially increased die life
- Smoother, safer press performance — simpler, thriftier servicing
- Less floorspace required

just send this...

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

Please rush new Bulletin 56 with all the facts on your brand new Series E Inclinable.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

mm

to get this...

26 FACT-FILLED PAGES

NIAGARA

front-to-back crankshaft INCLINABLE PRESSES

America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.

New Accuracy New

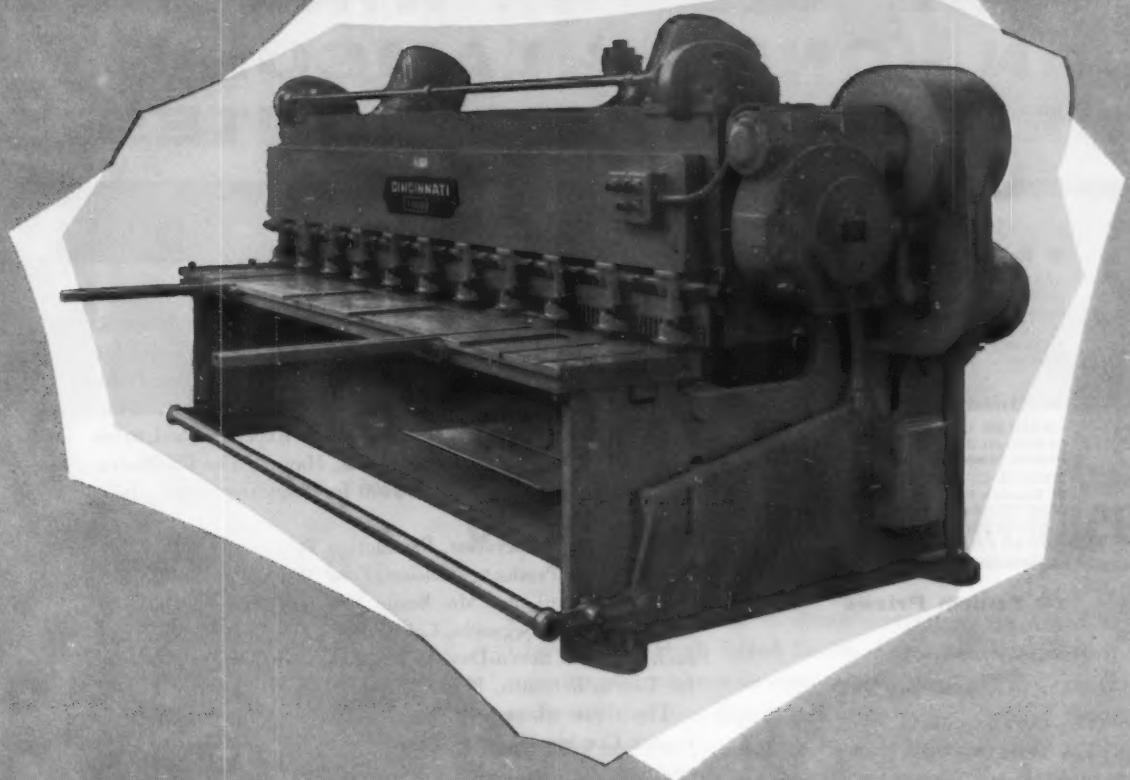
New Quiet

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Cincinnati Shears



New design in Cincinnati Shears has brought a new quiet and accuracy in performance.

New low rake has increased accuracy—producing blanks to very close tolerances with straight clean edges.

The new design, powerful hydraulic holddowns operate quietly and assure full pressure for holding. Front control of the power back gauge saves time in operation and gives a positive, accurate, easy control of gauging from operator's working position.

Write for catalog S-7R.

Grand Prize
ARMAND MONARD
9404 211 Street
Queens Village 28, N.Y.

HERE ARE THE WINNERS IN JONES & LAMSON'S NEW HORIZONS CONTEST

2 Second Prizes

ANDY TOROK
19322 Santa Clara
Detroit 19, Michigan

W. H. BRAUN, JR.
11048 Blix Street
N. Hollywood, California

3 Third Prizes

CHARLES LEO SADON
24 Endicott Street
Saugus, Massachusetts

JOSEPH C. BARRETTE
24 Rosedale Street
No. Providence 11, Rhode Island

LEON HAROLD RICE
RFD #2, Church Road
Bedford, New Hampshire

10 Fourth Prizes

Edward M. Alexander
RR 1, Box 234
Mooresville, Indiana

C. L. Robinson
1826 Chippendale Street
Houston, Texas

Daniel J. Ruggiero
Main Street, Box 7
Jonesville, New York

George G. Perla
2331 Colonial Avenue, S.W.
Roanoke, Virginia

Thomas M. Jackman
31909 Saginaw Court
Wayne, Michigan

Louis Marcolivio
260 Webster Avenue
Providence, Rhode Island

Euclid U. Lebert
408 Hillside Drive
Anderson, South Carolina

Bruce J. DeNeve
79 Varian Lane
Rochester, New York

Edward Gagne
30730 Horse Island Drive
Gibraltar, Michigan

Frank S. Wozniak
2331 Harrison Street
Schenectady 6, New York

J&L heartily congratulates the winners of the Jones & Lamson NEW HORIZONS CONTEST. As winner of the Grand Prize, Mr. Monard, who is Methods Engineer with Control Instrument Co., Brooklyn, N. Y., receives a Two-Weeks Luxury Vacation Trip for Two, All Expenses Paid, to his choice of one of the following: Paris, Hawaii, The Caribbean, The Canadian Rockies, Plus $400 for spending money, baby sitter fee, etc.

Mr. Torok (Supervisor, Production Process & Design Section, General Products Division, Ford Motor Company, Dearborn, Michigan) and Mr. Braun (Process Engineer, Hughes Aircraft Co., El Segundo, California) as Second Prize winners each receive a Seven-Day All-Expenses-Paid Luxury Vacation for Two to Bermuda, Plus $200 spending money.

The three winners of Third Prizes each receive a Shopmaster Combination Saw-Jointer Power Tool, complete with motor.

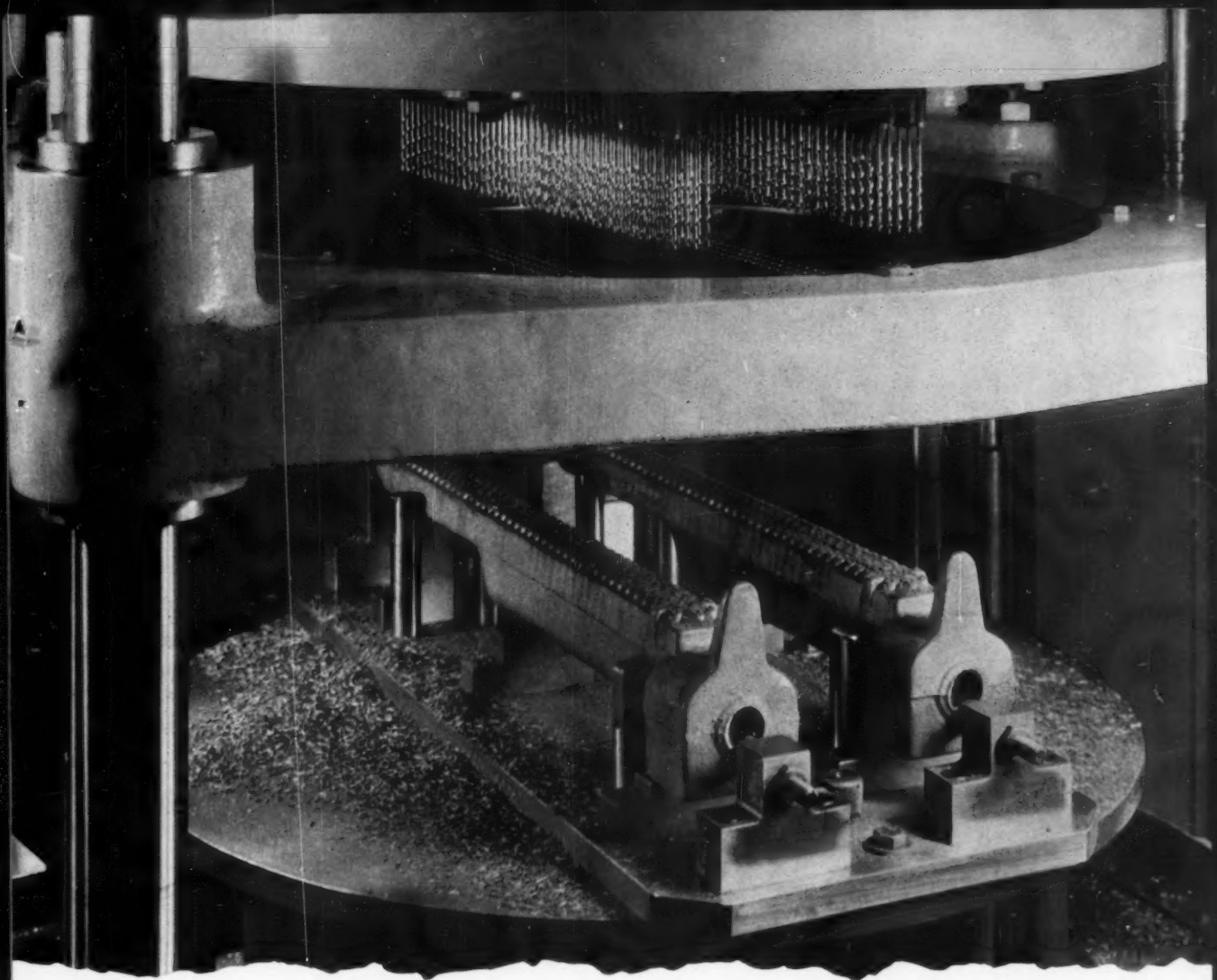
The ten winners of Fourth Prizes each receive a Shopmaster Individual Single-Purpose Power Tool (a choice of Saw, Drill Press, Jointer, etc.)

The Board of Judges, in announcing its decision, remarked that the general excellence of the many entries received made the judging process a most difficult one.

To all those who expressed interest in this contest, we extend our sincere appreciation and thanks.

JONES & LAMSON MACHINE COMPANY
512 CLINTON STREET, SPRINGFIELD, VERMONT

For more information fill in page number on Inquiry Card, on page 263



Uniform quality and high performance of CLE-FORGE High Speed Drills can help you reach production quotas

COSTLY "DOWN TIME" REDUCED!

● You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◈ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

A leading machine company, supplying gears for mining and a variety of other heavy machinery, uses Osborn's Brushamatic 4 and a brushing cycle of 6 seconds a side to finish these gears in lots of 20 and up.

Pays Off...

25 for 1

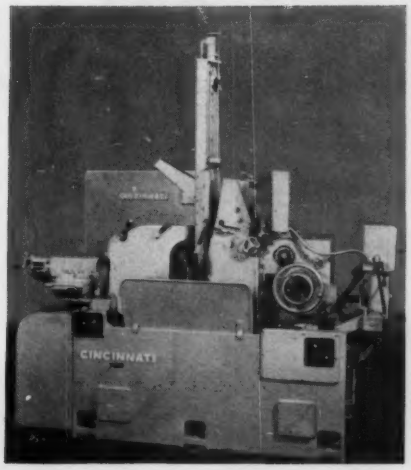
REMOVING burrs from the teeth and internal spline of this gear was once a 5 minute, hand filing operation. Using Osborn Brushamatic® methods, only 12 seconds are required to remove these burrs. In addition, power brushing blends all surface junctures, reducing fracture-causing concentrations of stress.

An **O**sborn **B**rushing **A**nalysis, made in your plant and at no obligation, will show how *you* can improve quality while making similar savings in finishing time and cost. Write *The Osborn Manufacturing Company, Dept. D-46, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

OSBORN

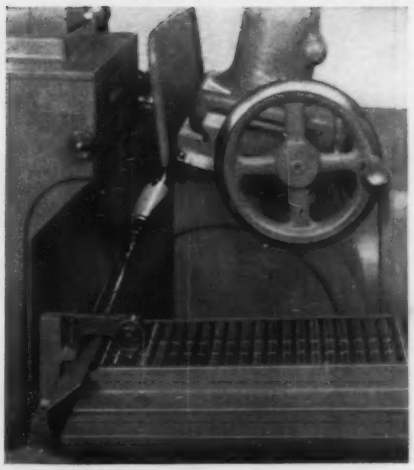
BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Osborn Brushes



Universal joint spiders. An ingenious loading device transfers the parts from one pair of wheels to the next. Four diameters are automatically ground each cycle. CINCINNATI® FILMATIC No. 2 Centerless Grinder.

Pump shafts. A magazine type work loading fixture and automatic infeed attachment help to reduce the cost of grinding bearing grooves. CINCINNATI FILMATIC No. 2 Centerless Grinder.



...and Cincinnati Centerless Automation

can reduce costs in your shop, too

Centerless grinding is a "natural" for automation. It can be developed to any degree required for your production, from a simple feed cycle to a complete line. Cincinnati Centerless grinding specialists have been doing this type of work for 33 years. That's one reason why it will pay you to consider Cincinnati first. Only Cincinnati can give you the advantage of long experience and a choice of *six sizes of centerless grinders*. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

Rocker arm shafts are loaded into the hopper at the left and transferred by conveyor from one CINCINNATI FILMATIC No. 2 Centerless to the next, and finally through the CINCINNATI FILMATIC Centerless Lapper at the far right.

Automotive valves. Parts are received from an overhead conveyor and automatically ground at the rate of 22 per minute. CINCINNATI FILMATIC No. 2 Centerless Grinder.

CINCINNATI

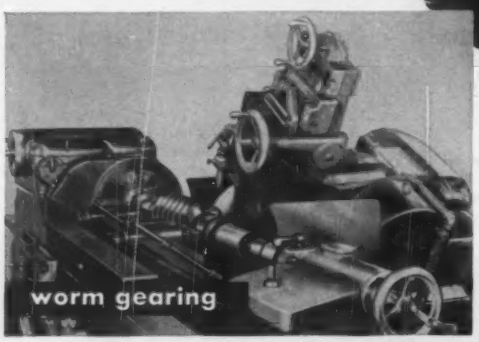
CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For more information fill in page number on Inquiry Card, on page 263

PHILLIE GEAR®

WORM GEARING by "Phillie Gear" assures you accuracy...efficiency ...dependability

See the newest developments in Mechanical Power Transmission at our Booth #80—22nd National Power Show, New Coliseum, New York City, November 26-30.



Worm grinding is an operation which is essential to successful worm gear operation... When worms are heat-treated for maximum surface hardness, the hardening process often produces changes in the lead angle and tooth profile, and always leaves a rough scaly surface on the threads. Worm thread grinding will correct errors of lead and profile, and produce a mirror-smooth surface finish, which is highly important to worm gear tooth action. Philadelphia worms up to 12" pitch diameter, 1 diametral pitch, are thread ground on our modern equipment.

Compactness • High Shock load and over-load capacity • Easy maintenance • Interchangeability of Components • Smooth torque flow • Positive control of work on driven machines • Long service life (worm gearing frequently improves with use) • Trouble-free performance • Good efficiency.

Any Worm Gearing, is, of course, only as good as the knowledge and equipment of its maker, plus the quality of alloys and methods used in making both Worm and Worm gear—This is where "Phillie Gear" is really tops.

Send for 72-page Gear Book #G-655, which tells you all about Worm Gearing, as well as other types of gears.

phillie gear®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

For more information fill in page number on Inquiry Card, on page 263

- 9" column; 3 or 4 arm
- spindle speed ratio of 40-to-1
- 12 speeds (up to 3200 rpm) through direct-reading dial
- automatic tapping reverse
- adjustable spring counterbalance (feel remains the same from lightest to heaviest tools)
- hardened tang slot
- safety elevating nut and screw (arm can't drop or overrun)
- hardened arm ways for head
- rigid accurate spindle mounted on 5 precision ball bearings

You can acquire this radial for only $.28 an hour, if you operate two 40-hour shifts, by using Gilbert's new financing plan: 6% simple interest (3% add on), up to 5 years to pay (subject to change)

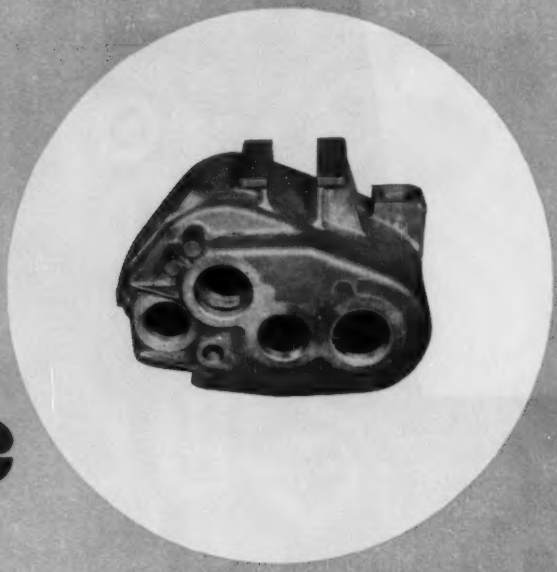
those who buy
GILBERT
buy Gilbert again

newest *high-speed* radial

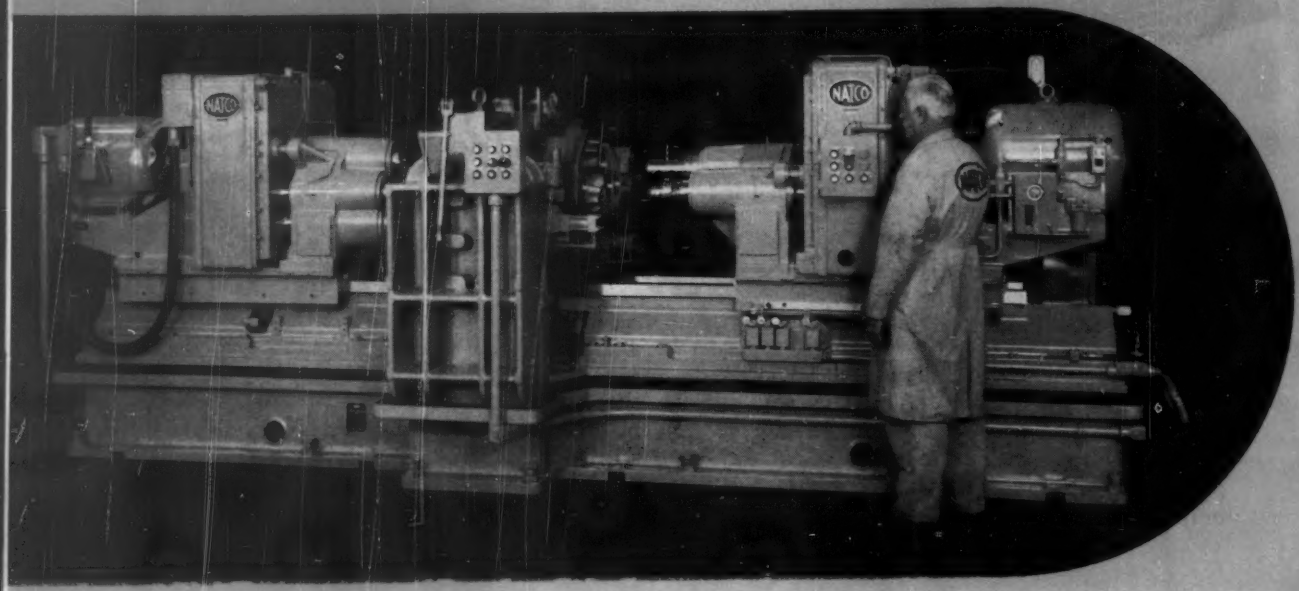
Your many demands for a high-speed light-duty radial are met—completely and economically—by this new Gilbert 3 hp machine. Compare the features at the right with other radials of equal capacity, and you see why the Gilbert is the best buy in its class. Traditional Gilbert accuracy, fast response, and wide-angle work visibility make your shop more productive, more versatile. Variety of bases, runway mounting, or tables available. Get all the details in Bulletin 255.

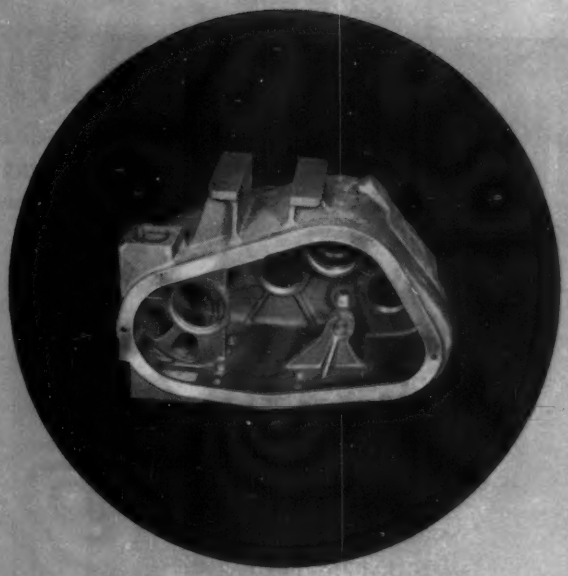
The Cincinnati Gilbert Machine Tool Co.
3346 Beekman Street, Cincinnati 23, Ohio

Natco® Automatic Matches Boring Mill Accuracy



and quickly converts for five different jobs





This Natco two-way machine stepped in where automatics "fear to tread!" It replaced a precision boring mill, speeded production and didn't give up a tenth in accuracy! At The Frank G. Hough Co. boring mills were used for exacting tolerances on transmission parts for the Hough Payloader®. Higher production was desired.

Now with a Natco two-way automatic, Hough is getting production rates—not job shop rates. The Natco bores diameters to within .0005"—square with mounting face within .0005" per inch bore length. The machine also chamfers, counterbores and notches boss contours.

Versatile too! Hough processes five different transmission housings or covers with a single machine. After a typical production run averaging 100 parts, the machine is quickly converted to another job.

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

Currently 86% of Natco's shipments are on or ahead of schedule.

National Automatic Tool Company, Inc. *Richmond, Indiana*

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

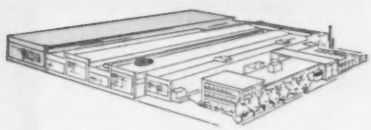
Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

NATCO

Notes from Natco...

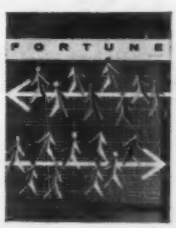
Middle Age Spread

Having reached the age of 55 feeling as spry as the day we started, we at Natco are going to spread out. The demand for our products makes this necessary since we're anxious to give our customers the kind of deliveries they need.



After Jan. 1, 1957, when the job is finished, we'll have eight acres under one roof at our Richmond, Indiana plant. We figure it will increase our production capacity about 50%.

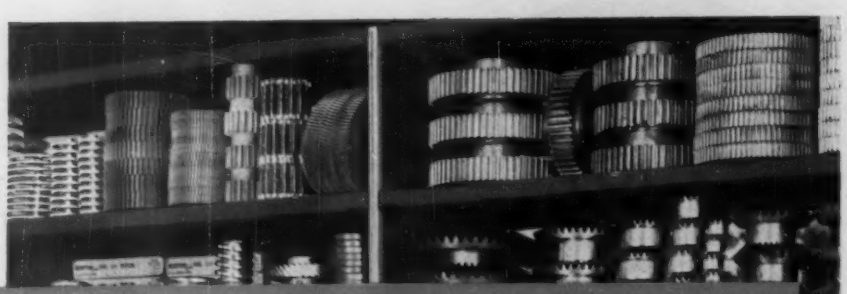
To take care of the increased need for Sales Service, we've already increased our staff about 50% and provided them with new efficient quarters.



Appreciating Depreciation

Depreciation, we've come to realize, is one of the least understood and most important aspects of the business picture today. Though we're far from experts on the ins and outs of this complex subject, we've undertaken to discuss the importance of looking at depreciation realistically in our current FORTUNE campaign. We'll be happy to send you reprints if you'll drop us a line.

When you plan for COST REDUCTION — use this time-proved FORMULA



Selection from the **BOSTON Gear CATALOG** All the parts you need from the complete line of 7124 STANDARDIZED PRODUCTS

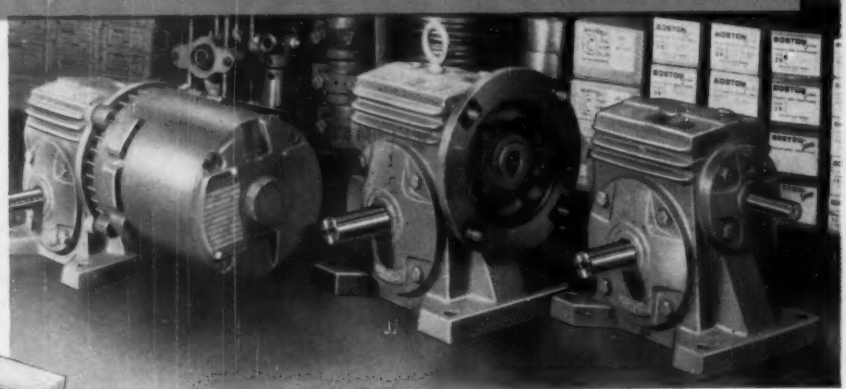
+

Ordering from your local **BOSTON Gear DISTRIBUTOR** anywhere in U. S. or Canada for prompt delivery OFF-THE-SHELF- AT FACTORY PRICES

=

Trouble-free . . . cost-wise **TRANSMISSION** design and maintenance **ECONOMY**

- You simplify planning
- You save time and expense
- You get recognized top-rating in quality and performance



Get the NEW Catalog No. 56

576 PAGES — lists all products

You'll find hundreds of new products, new models, new sizes — and 50 pages of simplified Engineering Data to help you plan new efficiency, new economy in any transmission hookup. Boston Gear Works, 65 Hayward Street, Quincy 71, Massachusetts.

BOSTON Gear is right here!

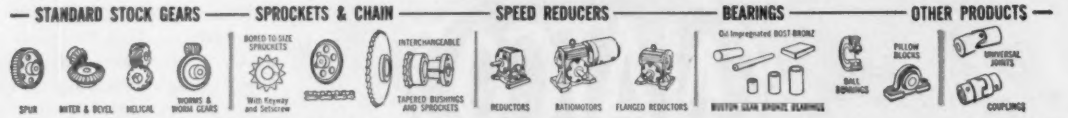
CALL YOUR

BOSTON® Gear DISTRIBUTOR

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book.

7124 "OFF-THE-SHELF" TRANSMISSION PRODUCTS FROM STOCK - AT FACTORY PRICES ASK FOR CATALOG

— STANDARD STOCK GEARS — SPROCKETS & CHAIN — SPEED REDUCERS — BEARINGS — OTHER PRODUCTS —

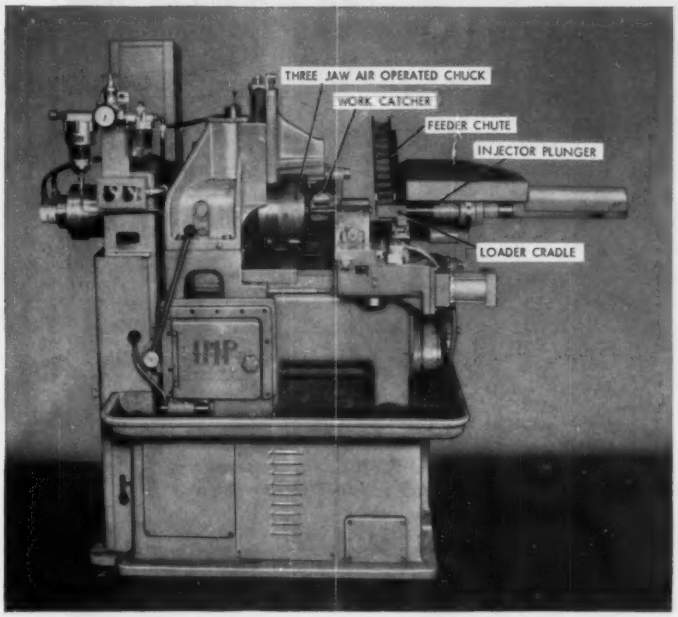


56BG-NC-25A

For more information fill in page number on Inquiry Card, on page 263

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Lo-swing IMP AUTOMATIC LATHE MACHINES CAST IRON SLEEVES AT A FAST PACE

PROBLEM: To bore, face and partially turn cast iron sleeves on a full automatic cycle including loading and unloading.

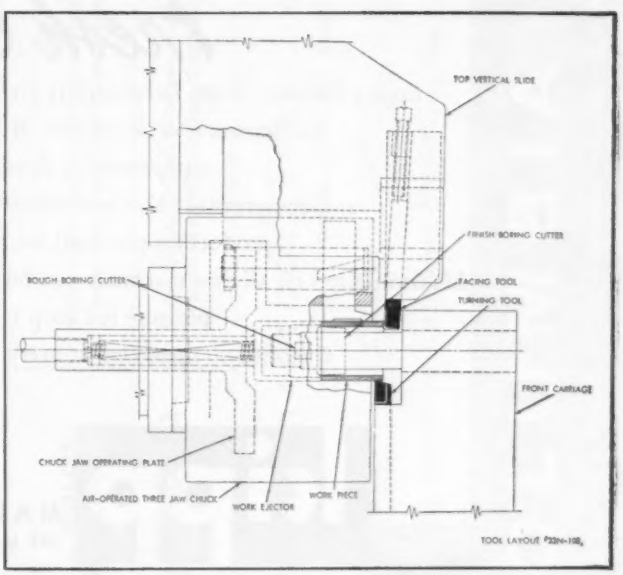
SOLUTION: A Lo-swing IMP Automatic Lathe was selected for this job due to its rigidity, compactness and productivity when equipped with Seneca Falls Automatic Injector Type Work Handling Equipment.

The cast iron sleeves, 1-13/16" in diameter and 2" long, are delivered at the machine direct from the foundry and are placed in the feeder chute where they flow by gravity into a loader cradle. In this position, the sleeves are picked up, one at a time, by the pneumatically operated injector plunger, and injected into the three-jaw air-operated chuck. The injector plunger remains in the advanced position until the chuck jaws automatically close, and then retracts to the relieved position.

The machining cycle starts with the Front Carriage and Overhead Slide tools approaching the work piece in rapid traverse. They then slow down to feed and finally return to the starting position in rapid traverse. Upon completion of the machining, an automatic work catcher swings forward, the chuck jaws are retracted and the work piece is ejected into the iron hand by means of the spring-loaded work ejector shown in the line drawing. The work catcher is then retracted and the finished piece drops into the unloader chute at the rear of the machine.

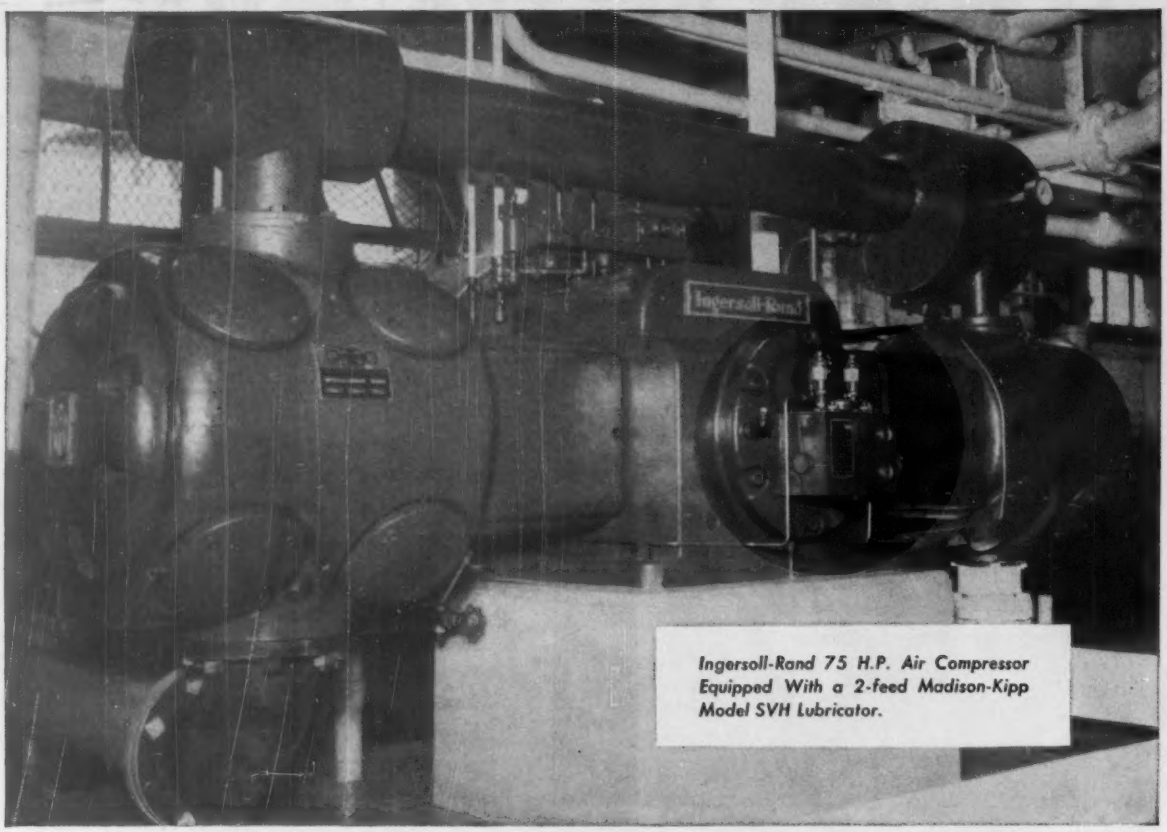
The entire operation is fully automatic, and a production of 147 pieces per hour is easily maintained. Our engineers are at your service to solve your automatic machining problems. Write for Bulletin N50B.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.



TOOL LAYOUT

PRODUCTION COSTS ARE LOWER WITH Lo-swing



Ingersoll-Rand 75 H.P. Air Compressor Equipped With a 2-feed Madison-Kipp Model SVH Lubricator.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil ... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

YOUR GUIDE TO COLUMBIA HIGH SPEED TOOL STEEL GRADES

TYPE AND GRADES	DESCRIPTION	HARDENING RANGE	QUENCH	TEMPERING RANGE	USEFUL HARDNESS
T1 — CLARITE	Standard type, high red hardness, good strength, wide range of use with high over-all efficiency	2000° F. to 2350° F.	Oil or Salt Bath	1000° F. to 1250° F.	65/60 Rc
T2 — VANITE	Increased carbon and vanadium; best for form tools and finishing cuts	2300° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1050° F.	66/63 Rc
T4 — ACMITE	18-4-1 high speed steel with 5.00% cobalt added; for heavy cuts, all around high speed cutting with long life at high speeds.	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1025° F.	66/64 Rc
T5 — COBITE	18-4-2 with 8.00% cobalt high speed steel, extreme red hardness, for hogging cuts on scaly and hard abrasive materials	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/64 Rc
T8 — MAXITE	High carbon, high vanadium with 5.00% cobalt. High production steel for cutting hard castings and tough heat treated alloy steels	2325° F. to 2375° F.	Oil or Salt Bath	1025° F. to 1075° F.	66/63 Rc
M2 — MOLITE SMOOTHCUT	Molybdenum-tungsten multipurpose high speed steel with smoothcutting additives for greatest economy	2100° F. to 2275° F.	Oil or Salt Bath	1000° F. to 1250° F.	66/58 Rc
M3 — MOLITE 3	Molybdenum-tungsten high speed steel with higher carbon and vanadium for fine cuts including broaching and reaming	2175° F. to 2250° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/63 Rc

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILLINOIS

CENTRAL OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS — BRANCH STOCKS IN THE FOLLOWING CITIES:

Chicago 32, 4839 S. Kedzie Ave., Phone LAfayette 3-3632
Cincinnati 25, 2716 Spring Grove Ave., Phone MUlberry 1-8400
Cleveland 14, 1640 St. Clair Ave., Phone MAin 1-1785
Detroit 3, 121 Oakman Blvd., Phone TUlsa 3-3770
Los Angeles 22, 6955 E. Bandini Blvd., Phone RAymond 3-4684
Milwaukee 4, 426 S. Sixth St., Phone BRoadway 6-0255
St. Louis 13, 5118 Easton Ave., Phone FOrest 1-0641

REPRESENTATIVES IN THE FOLLOWING CITIES: Dayton, Erie, Grand Rapids, Hartford, Indianapolis, Louisville, Moline, Newark, Portland and St. Paul

1957

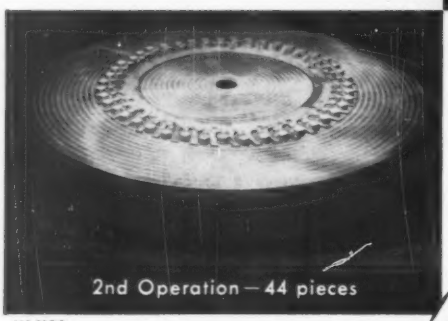
TOOL COLUMBIA STEELS

COLUMBIA TOOL STEELS

DIE STEELS: Superdie — Atmodie — E-Z-Die Smoothcut — Exl-Die — CEC Smoothcut HOT WORK STEELS: Clarite HW — Formite #3 — Formite #2 — Molite HW10 — Vanadium Firedie — Alcodie — Firedie CARBON TOOL STEELS: Columbia Special — Vanadium Extra — Waterdie Extra — Columbia Extra — Columbia Extra Headerdie — Vanadium Standard — Columbia Standard

Another example

W-1138



W-1139

# of Blanchard versatility

No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

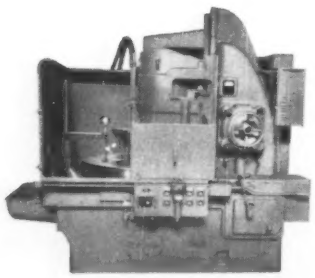
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!

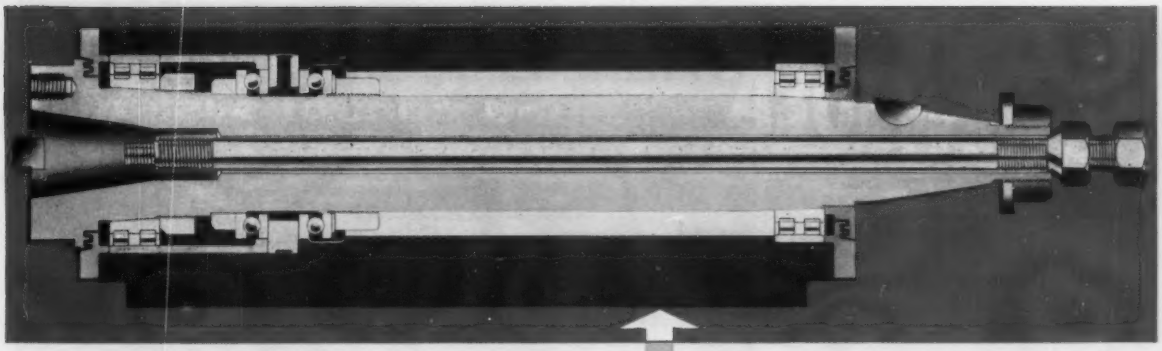


Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

For more information fill in page number on Inquiry Card, on page 263

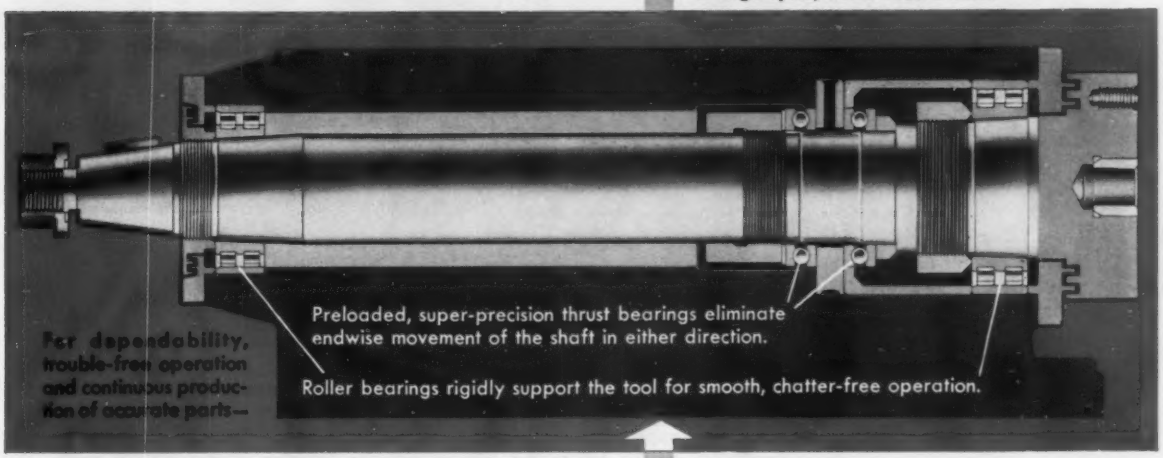


PRECISION MILLING
calls for this
POPE
Heavy Duty
MILLING SPINDLE

See for yourself! Here is one sturdy package with a massive shaft, and double row cylindrical roller bearings and ball thrust bearings that support your cutting tools rigidly to do their best work.

POPE P-12000 Series Belt Driven Precision Milling Spindles are operable in any position. They come in sizes from 1 to 50 HP with standard milling machine tapers in the nose from #10 to #60. Bulletin S-8 gives complete dimensions. Let us mail you a copy.

POPE Heavy Duty Milling Spindles are also available in P-2500 Series, MOTORIZED, from 1 to 100 HP, totally enclosed, fan cooled; and in high cycle, water cooled units.


Preloaded, super-precision thrust bearings eliminate endwise movement of the shaft in either direction.
Roller bearings rigidly support the tool for smooth, chatter-free operation.
For dependability, trouble-free operation and continuous production of accurate parts—

PRECISION BORING
calls for this
POPE
Heavy Duty
BORING SPINDLE

Look it over! Here is a Boring Spindle capable of boring holes round within *millionths of an inch.* It produces fine surface finishes in the lower micro inch range.

POPE Super-Precision Heavy Duty Boring Spindles are available in both belt driven and motorized units to meet a wide range of speeds and horsepower. Send us your specifications for quotations.

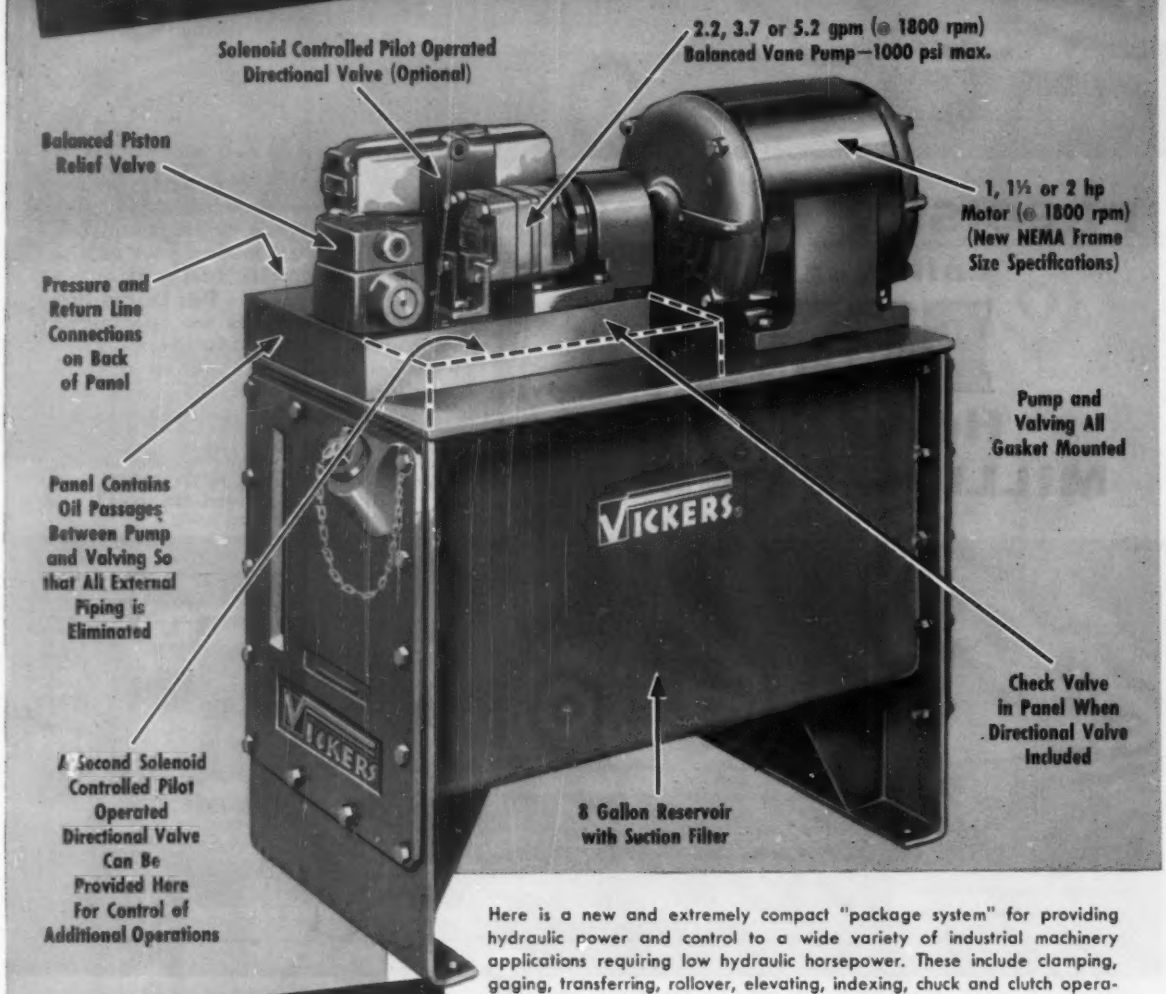
Pope designs, engineers and builds
SPECIAL SPINDLES

No. 112

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

A NEW IDEA . . . in hydraulic power and control systems


Solenoid Controlled Pilot Operated Directional Valve (Optional)
2.2, 3.7 or 5.2 gpm (@ 1800 rpm) Balanced Vane Pump—1000 psi max.
Balanced Piston Relief Valve
1, 1½ or 2 hp Motor (@ 1800 rpm) (New NEMA Frame Size Specifications)
Pressure and Return Line Connections on Back of Panel
Pump and Valving All Gasket Mounted
Panel Contains Oil Passages Between Pump and Valving So that All External Piping is Eliminated
VICKERS
A Second Solenoid Controlled Pilot Operated Directional Valve Can Be Provided Here For Control of Additional Operations
Check Valve in Panel When Directional Valve Included
8 Gallon Reservoir with Suction Filter

Here is a new and extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

VICKERS Series T8 HYDRAULIC PIPELESS POWER PACKAGE*

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

Application Engineering Offices: • ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

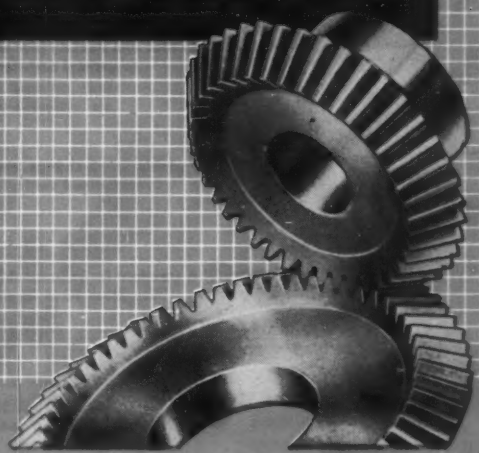
7311

*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

THE ULTIMATE IN

BEVEL GEAR ACCURACY



- low-cost tooling
- simplicity of set-up

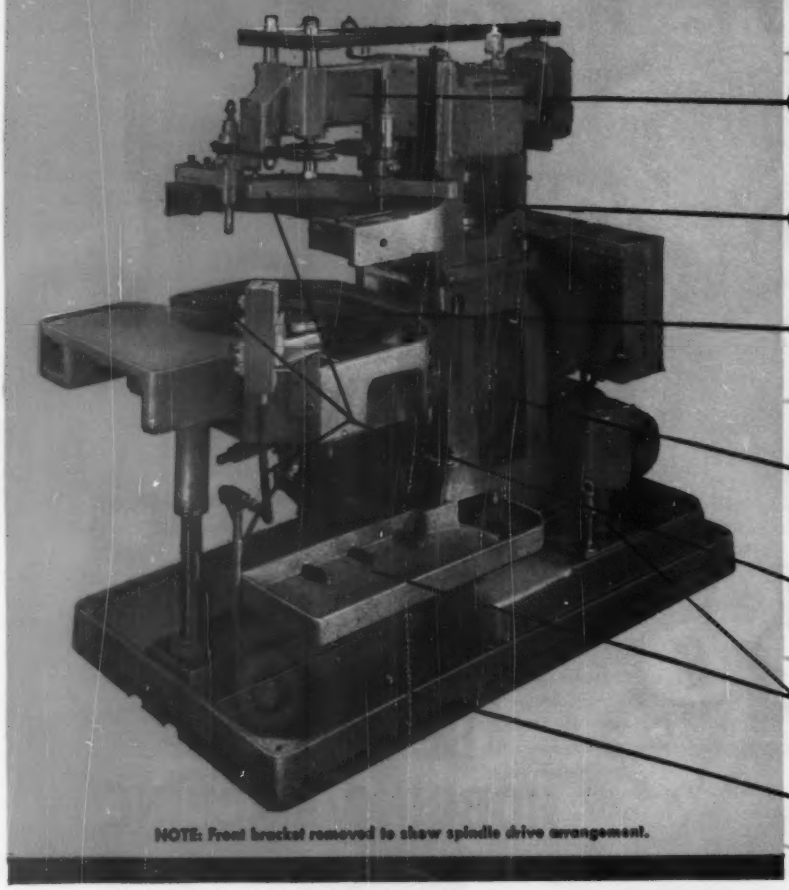
NO. 120 MIKRON

fine pitch
BEVEL GEAR HOBBING MACHINE

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

SAVE TIME AND MONEY
BY BUILDING YOUR "SPECIALS"
WITH Bodine



NOTE: Front bracket removed to show spindle drive arrangement.

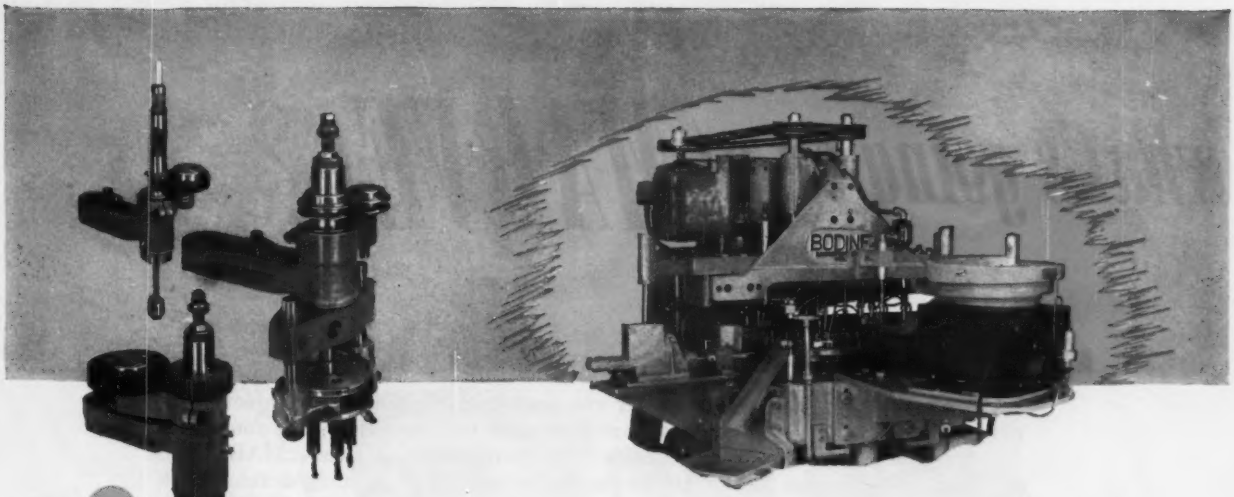
BASIC UNITS

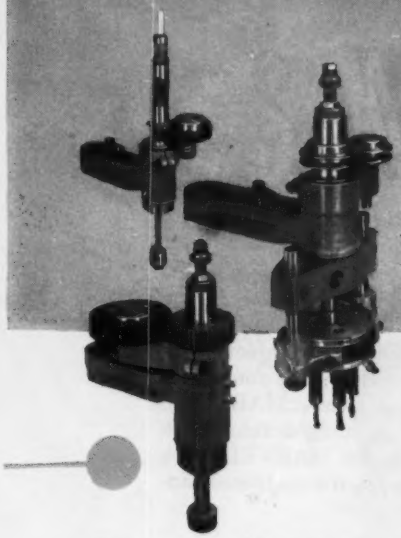
- Central and flexible jack shaft drive to vertical spindles.
- Variable, quick-change, cam-controlled, synchronized vertical motion.
- 6 standard interchangeable table indexes, from 10 to 24 stations.
- All power drive through SINGLE main shaft for simple timing and adjustment.
- Ample mounting surfaces for tooling and attachments. Tool mounting areas are standard, making all tooling interchangeable.
- Central coolant system.
- 4 standard Basic Machine sizes.

Few pieces of production equipment available today can match the practically unlimited versatility of this Bodine Basic Machine or the features it offers at such remarkably low cost. Equally important . . . while every day sees NEW developments in tooling and application, the BODINE MACHINE and standard tooling equipment remain as well-proved BASIC designs from which the "bugs" have long since been eliminated.

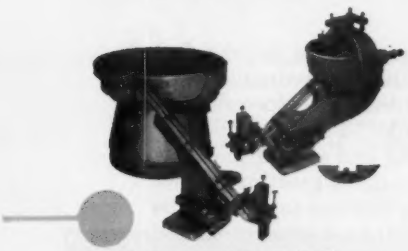
Bodine BASIC Machines are made in four sizes capable of high volume production of a wide range of small interchangeable parts, especially where multiple operations are required. The Basic Machines and spindle units may be purchased separately or in any combination by those who wish partially or wholly to design and build their own specials.

18D56L

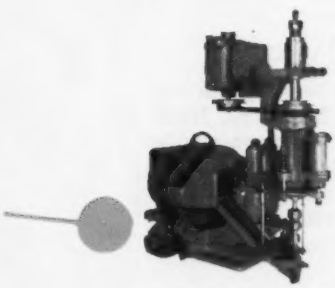




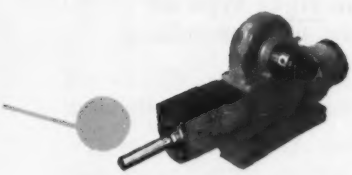
Wide range of standard spindles for drilling, reaming, tapping, threading, milling, screw-driving, etc.



Service-proved standardized automatic feed methods and units.



Screw-inserting mechanisms available as complete units.



Standardized spindles for horizontal, inverted or angular mounting.

YOUR STANDARDIZED, FLEXIBLE ANSWER TO...

HIGH PRODUCTION NEEDS

MULTIPLE TOOLING PROBLEMS

RAPID CHANGE-OVER

Time and again we hear the statement, "If we had known what can be done with a Bodine Basic Machine, we would have saved ourselves a lot of headaches in building our own specials."

Simplicity is the keynote of Bodine Basic design... simplicity combined with positive precision operation and control to assure accurate repetition of production cycles.

A single main drive camshaft times and controls all indexing and tool feed motions with full provision for simple, precise mechanical adjustment. This permits extremely accurate timing of all operations in the cycle with positive mechanical interlock. It also makes for ideal accessibility for changing of cams, aiding in rapid change-over.

Another important Bodine feature is the very broad range of standard spindle types and sizes available, which can be modified if necessary to meet essentially any practical need. Drill spindles are available in four standard sizes and are easily adjustable for a wide range of speeds. They carry a micrometer adjustment for extremely fine setting. Bodine specially designed tapping spindles can consistently maintain Class 2 (plus) fits. Lead screw units are available for Class 3 fits. Horizontal, angular and inverted spindles are fitted to many machines.

Furthermore, you no longer need to consider the investment in a "single-purpose" machine at production termination. Investigate these unusually successful Bodine Basic Machines and methods. In nine cases out of ten, we can give you a PRE-TESTED answer to your problem at far less cost. Write outlining your needs... or send us prints and samples for analysis... **to Dept. M-10.**

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

13D56R

what's going on at MARVEL?

1. A NEW BUILDING PROGRAM...

Not long after you read this, we will have completed the MARVEL plant expansion program which will *double* our already considerable manufacturing space. MARVEL'S confidence in the future and its continuing development, coupled with the increasing demand for MARVEL Hack Saws, Band Saws and Hack Saw Blades, makes this expansion mandatory.

2. A NEW "SUPER" BAND SAW

In our enlarged plant, we will demonstrate for the first time, a completely new, heavy duty, all-hydraulic, fully universal MARVEL Band Saw designed especially for High Speed Steel Band Saw Blades. This new "Super" Band Saw is heavier, more powerful and rugged than any band saw yet available. It incorporates a great many new and exclusive design and operating features to make it the most advanced Band Saw for BOTH high production and universal work.

3. AN INVITATION TO "TRY" BEFORE YOU BUY

One or more of the new Band Saws will be set up in our new plant, together with new, improved MARVEL Hack Saws, to demonstrate comparative performance on a wide variety of work. We will also set up specific cutting-off jobs requested by customers or prospective purchasers on *both* types of machines and arrange to have interested personnel observe and check the demonstration of comparative saw performance *on their own work.*

What better way is there to prove to yourself the speed, accuracy, efficiency and economy of MARVEL Saws and to select the right type of saw (hack saw or band saw) to best fit your individual job requirements?

G—1600

ARMSTRONG–BLUM MFG. CO.
5700 Bloomingdale Avenue • Chicago 39, Illinois

MARVEL Metal Cutting SAWS
Better Machines–Better Blades

Because these solenoid covers are essential to valve operation, they are chained to the valves. Also, they fasten with 4 "captive" screws that cannot be mislaid. A manual operating button makes it possible to operate the valve without removing its cover.

Now! solenoid-controlled air valves that defy improper maintenance ...they won't operate with their covers off!

When a solenoid valve operates without its cover, trouble is not far off. Dirt, oil, cutting fluid, chips are sure sooner or later to jam the solenoid, and the valve will fail to shift.

That can't happen with these new Hannifin valves!

The solenoids are held in place by their covers and won't operate the valves unless the dust-tight, splashproof covers are firmly tightened.

These new valves, which conform to the latest J.I.C. recommendations, are part of the complete "P-M" Pilot-Master line. New heads with these new solenoid covers are offered on 2-way, 3-way and 4-way Pilot-Master Valves (air-operated). The smaller, direct-operated 3-way and 4-way valves in the "P-M" line have been redesigned to use the same new covers. This added feature is just another reason why it pays to standardize on Hannifin air control valves.

For more information fill in page number on Inquiry Card, on page 263

AIR CONTROL

HANNIFIN

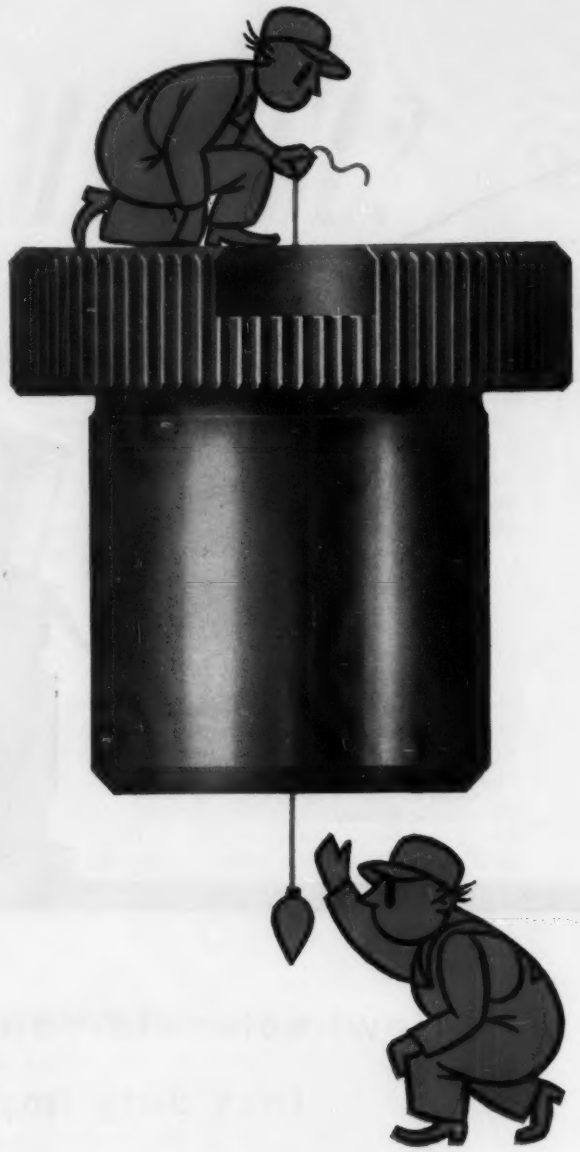
VALVES

Complete information on all Hannifin Air Control Valves is in this catalog. It belongs in your files. Write for your copy. Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Illinois.

FOR PERFECT ALIGNMENT...

UNIVERSAL
DRILL BUSHINGS

Universal Drill Bushings help increase efficiency and simplify jig drilling operations by insuring perfect alignment of drills. Blended radius on the top inside diameter guides the drill into place and helps prevent tool hang-up and breakage. Superfinish bores keep tool wear to a minimum, especially in close tolerance work. 100% concentricity and hardness tests insure accuracy and uniform high quality. Knurled heads provide a quick, sure grip. Made in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.



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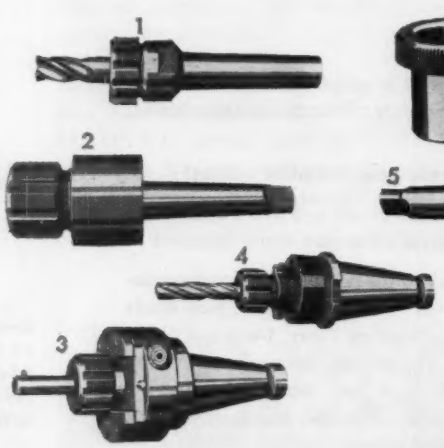
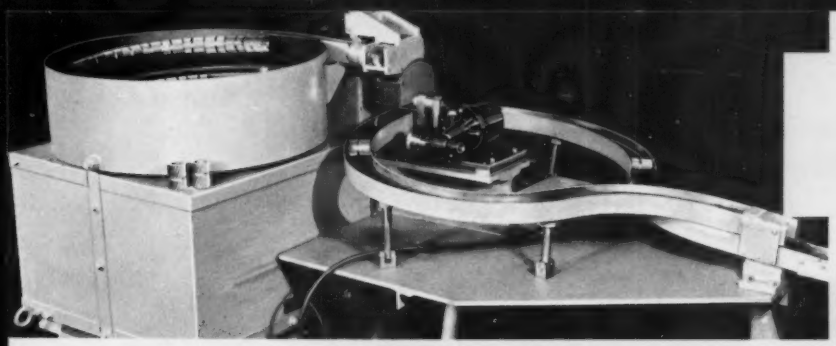
UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2
MICHIGAN



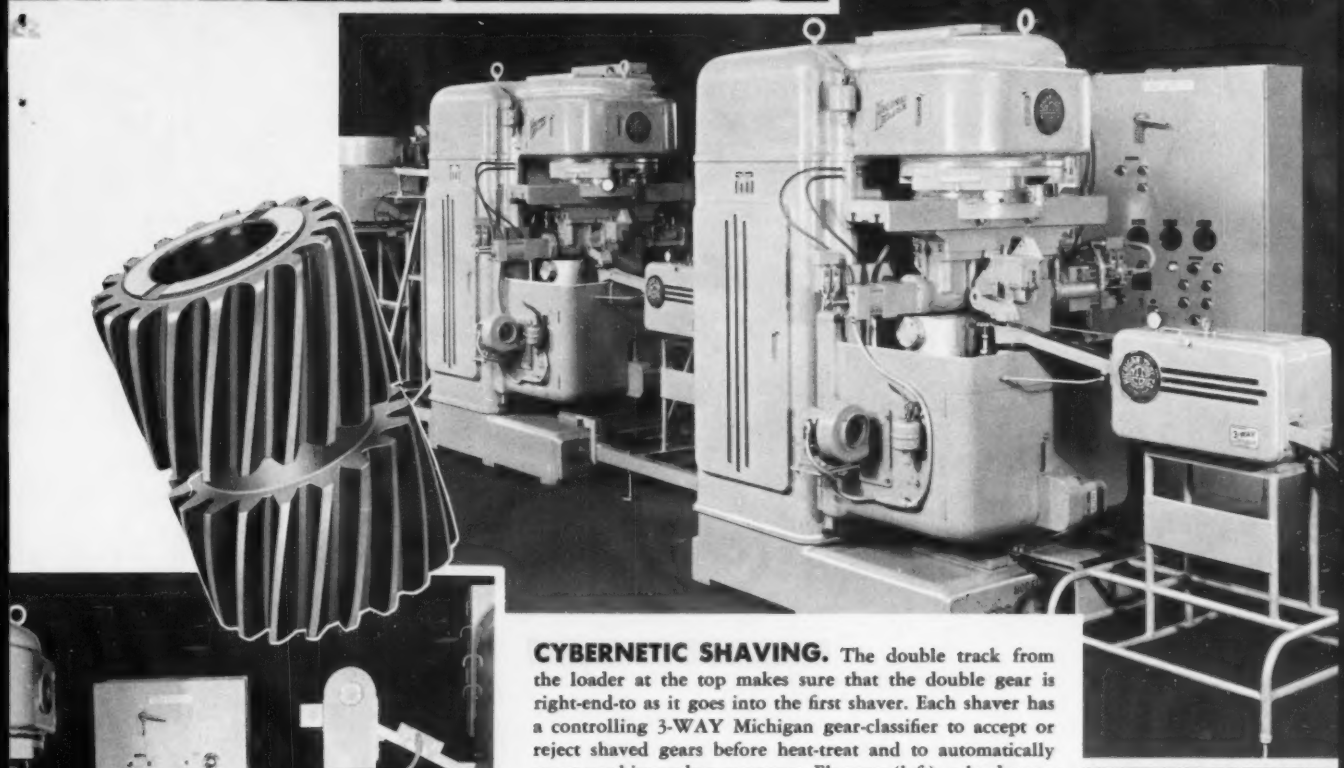
1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

For more information fill in page number on Inquiry Card, on page 263

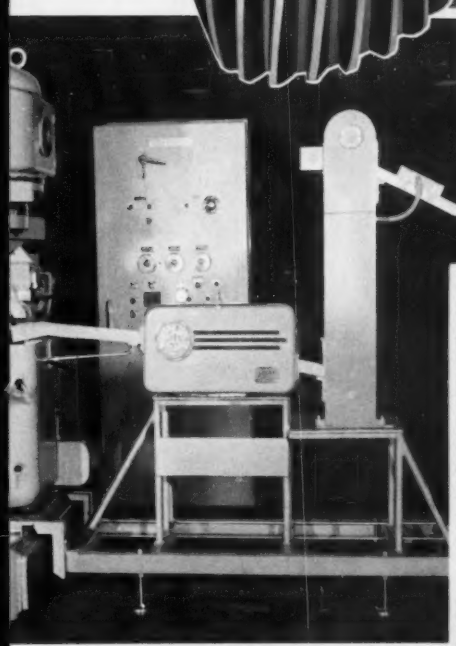


This Month's

GEAR PIX



CYBERNETIC SHAVING. The double track from the loader at the top makes sure that the double gear is right-end-to as it goes into the first shaver. Each shaver has a controlling 3-WAY Michigan gear-classifier to accept or reject shaved gears before heat-treat and to automatically re-set machines when necessary. Elevator (left) re-loads gear into shaver #2.



FULLY AUTOMATIC SOUND TESTING follows heat-treat. These Michigan speeders (right) with tunable electronic audio-pickup eliminate variable human element in sound testing. Can be set to reject gears for excess noise in any desired pre-selected frequency band.

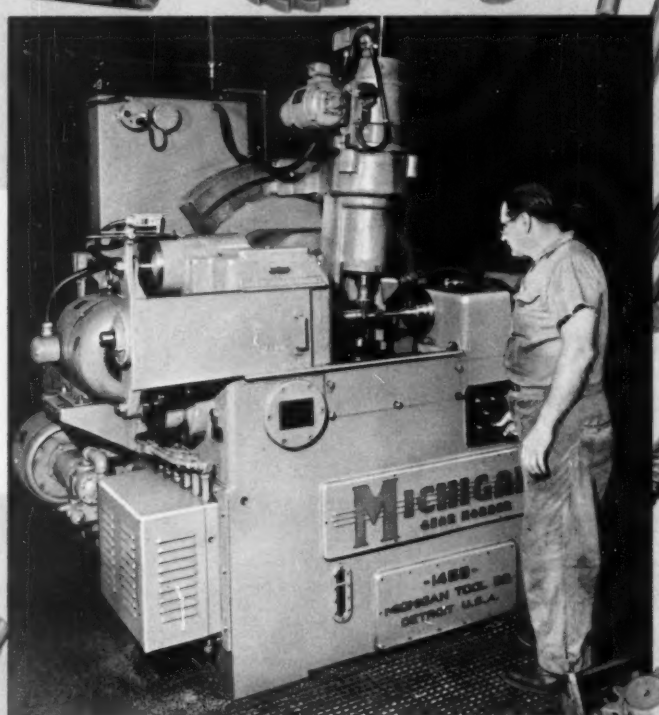
MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

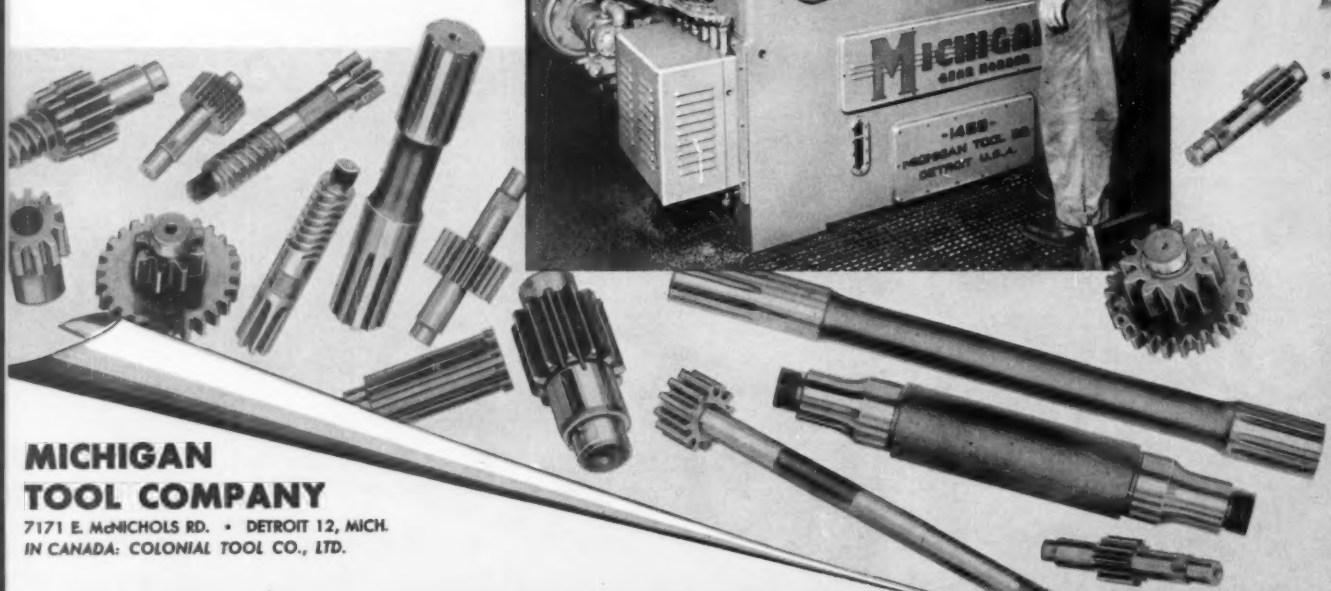
This Month's

GEAR PIX



105 PARTS HOBBED ON JUST 3

Ultra-Speed hobbers regularly by a major lift-truck producer. Shows how high production machines can be used effectively for shorter runs. Hobbing is mostly at 250 sfpm (SAE4185) with far longer hob life and number of parts per grind. Change-over averages about 1½ hrs. (same as previously).

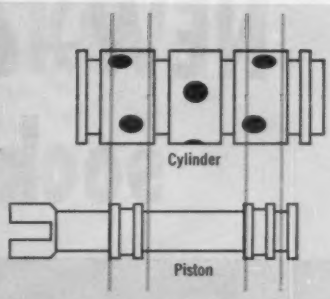


MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

MATCH PISTON LANDS TO CYLINDER PORTS PRECISELY WITH SHEFFIELD'S MICRO-FORM GRINDER



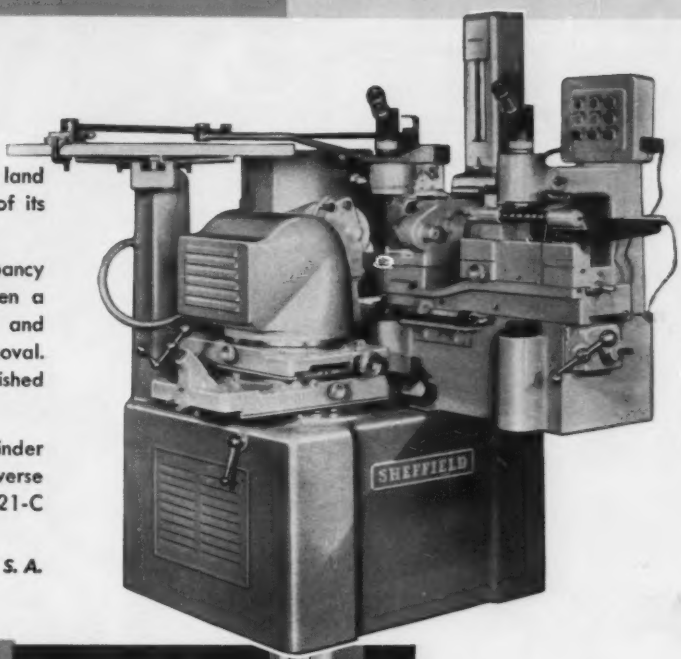
This servo cylinder and piston are typical of the very precisely machined hydraulic components in aircraft propeller and flight control systems.

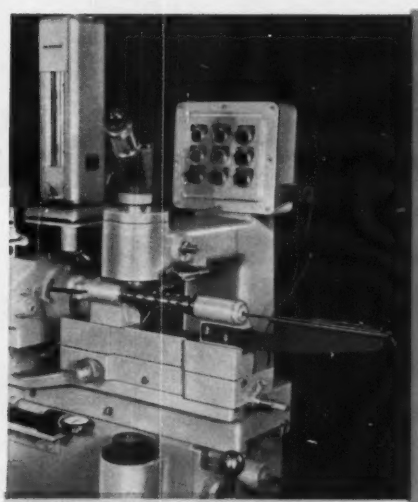
With the actual cylinder as a reference, each piston land is individually ground to match the inside edge of its respective cylinder port.

If a flow test then reveals the slightest discrepancy between land and port edge, the piston is given a finishing touch, using a Sheffield Precisionaire and Airetest Indicator to show progress in stock removal. Thus, the correction of the land face can be accomplished to within ± .000010".

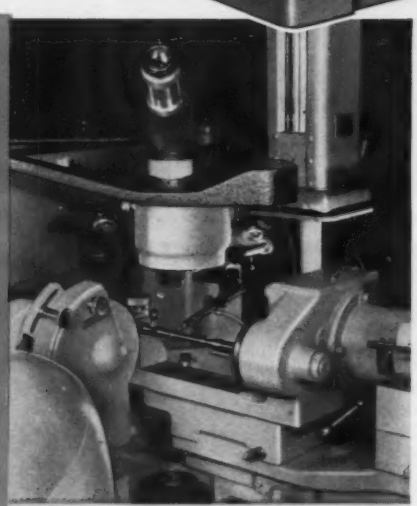
This is typical of the wide range of Micro-Form Grinder applications in duplicating precision profiles or reverse profiles from a master. Write for Bulletin MFG-121-C to Dept. 9

THE SHEFFIELD CORPORATION, DAYTON 1, OHIO, U. S. A.





Cylinder under observation on auxiliary table.



Airetest Indicator shows stock removal in final correction.

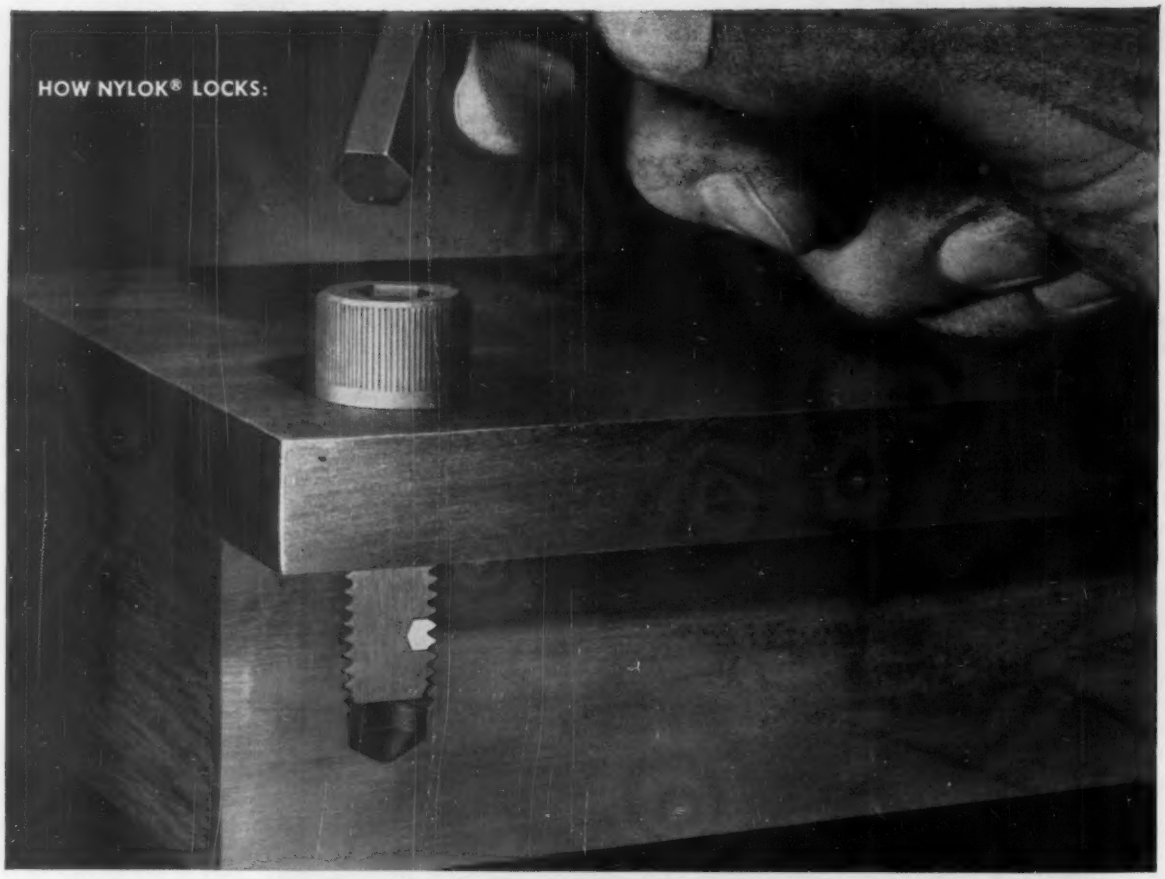
7560

GOLDEN ANNIVERSARY HEADQUARTERS

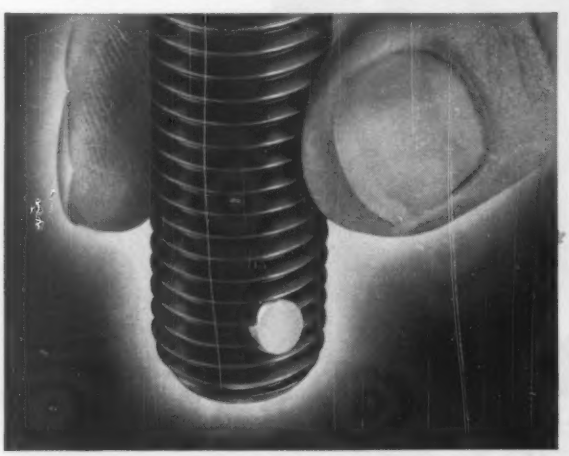
SHEFFIELD

manufacture and measurement for mankind

NEW—a complete line of socket screw products



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.



BEFORE ASSEMBLY. The nylon pellet projects slightly beyond male threads. When assembled, female threads will be impressed into it. Pellet locks effectively whether the screw is seated or not.

AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

self-locking UNBRAKO that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

An UNBRAKO screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

You save production time when you build products with self-locking UNBRAKOs. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-locking UNBRAKOs are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

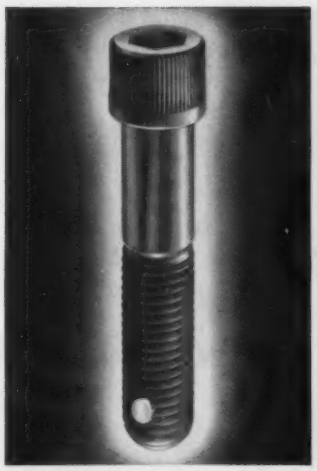
**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

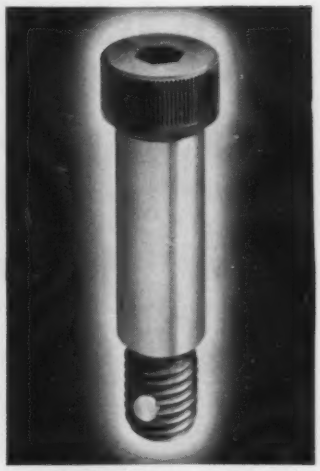
STANDARD PRESSED STEEL CO.

SPS

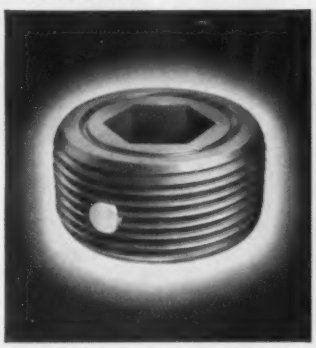
JENKINTOWN PENNSYLVANIA



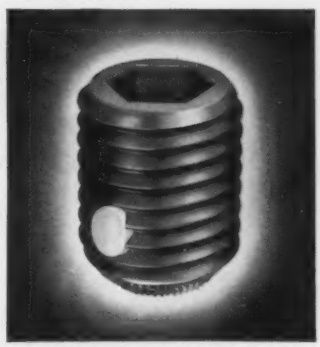
Socket head cap screws. Standard sizes #6 to 1 in.



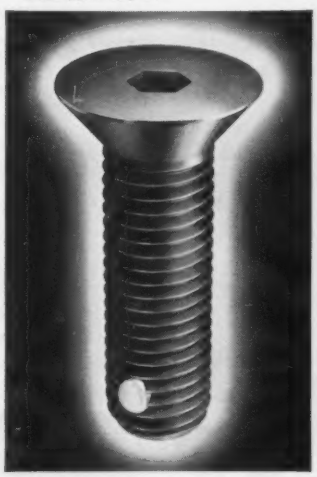
Socket shoulder screws. Standard sizes ¼ to ¾ in.



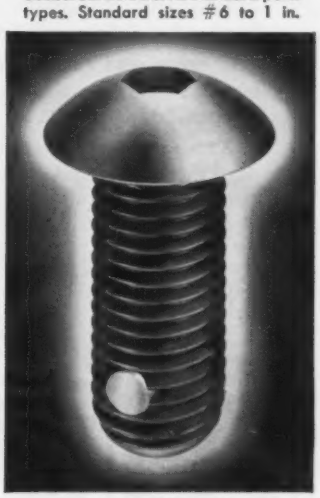
Socket pressure plugs. Standard sizes ⅛ to 1¼ in.



Socket set screws. All standard point types. Standard sizes #6 to 1 in.

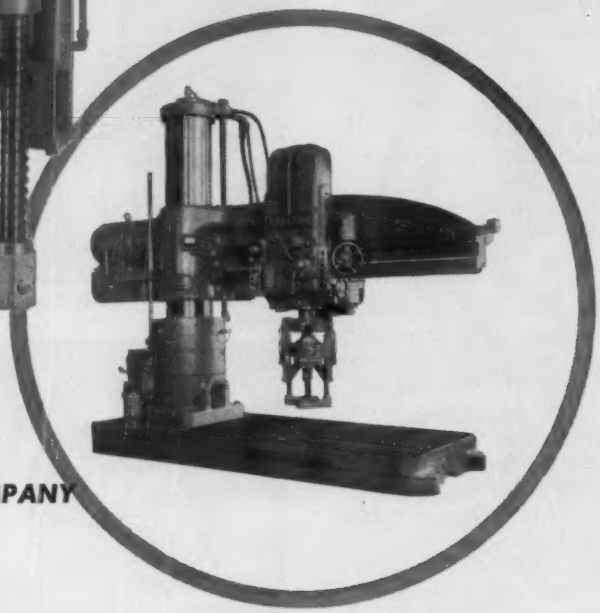


Flat head socket screws. Standard sizes #6 to ¾ in.



Button head socket screws. Standard sizes #6 to ⅜ in.

New
DRILL HEAD
AIR COUNTERBALANCE SWIVEL ATTACHMENT
FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

For more information fill in page number on Inquiry Card, on page 263

No other automatic on the market provides as high a degree of accuracy for work up to 2" diam. as the Brown & Sharpe No. 4 Automatic Screw Machine! And its advanced design permits top productivity on every job. For example: Super-precise spindle construction allows limits as close as 0.0003" — even at top speeds! Engineered production rates for each job *assure* maximum precision and efficiency under all conditions — hold repetitive production to close tolerances. A large, extra-convenient turret speeds set-ups and adjustments. In addition, electric control allows tools to be "jogged" easily into position; or a complete cycle to be run through by hand. And the No. 4's exclusive spider-wheel stock loader enables even a 100-lb. girl operator to easily engage a 2" bar! The unique capabilities of the No. 4 Automatic are making possible new profits in precision production — even on critical jobs like the one illustrated. It's the most *practical* automatic for all larger precision work. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

THE MOST ACCURATE AUTOMATIC for larger work!

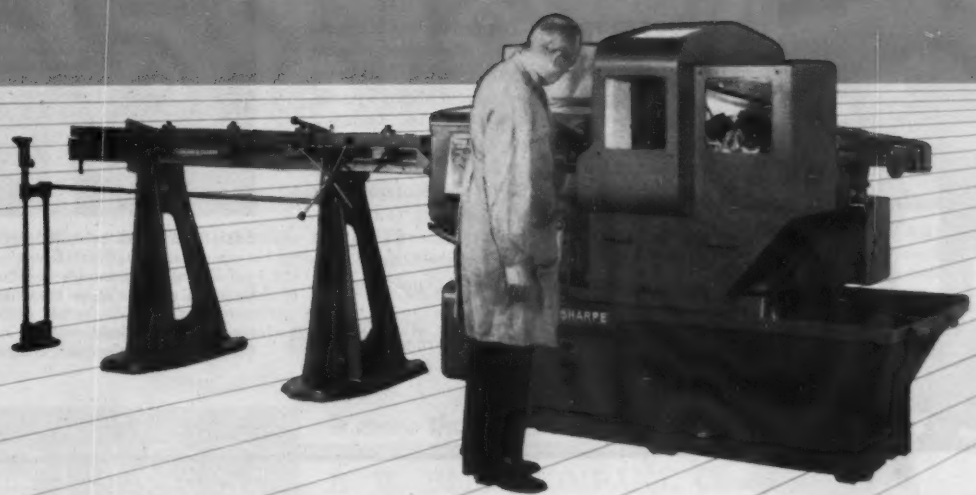
. . . the Brown & Sharpe No. 4 Automatic Screw Machine

MACHINE SPECIFICATIONS

Stock diameter	to 2"
Stock diameter (with outside feed)	to 2⅛"
Speed range	1965 to 17 R.P.M.
2-speed combinations	168
Speed ratios (12)	2.2:1 to 13:1

Even this Job is Easy on the No. 4!

Tolerances:
Bore I.D. 0.0003" to 0.0005"
Concentricity of bore 0.0005"
Large O.D. 0.0005"
(Overall diameter of work approx. 2")



BS **Brown & Sharpe**

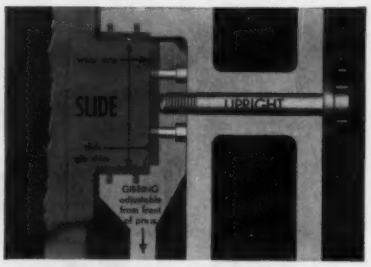
if you manufacture parts *like these...*

A BLISS HIGH PRODUCTION PRESS may triple your output...or more

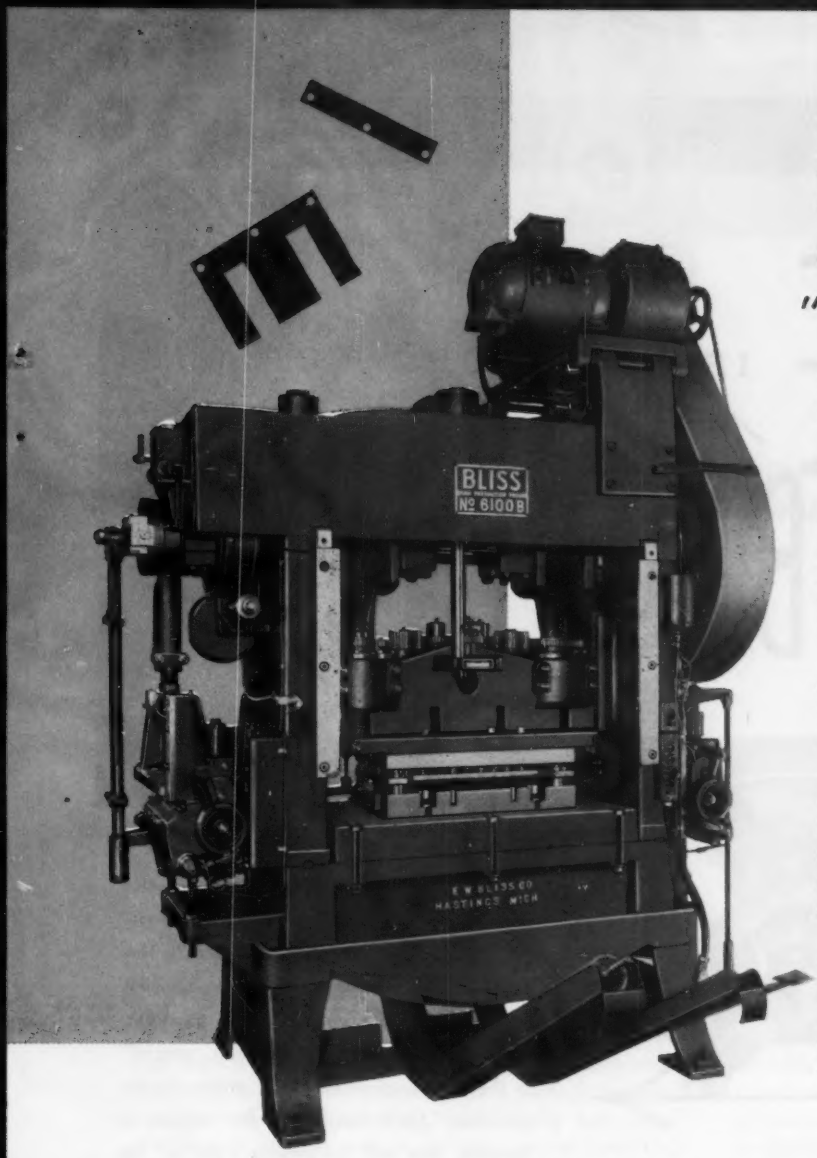
EXCLUSIVE DESIGN FEATURES...assure accuracy at high speed

RUGGED FRAME: The dense, cast Meehanite frame *absorbs sound*, eliminates ringing "ping" at high speeds. Heavy four-piece frame members are keyed and joined by steel tie rods which are "pre-shrunk" to a tension greatly exceeding press capacity. Extra heavy sectioned bed and crown holds deflection to a maximum of 0.001" per foot at press capacity under normal loading conditions. Heavy reinforced crown gives extra support to the shaft. The design of the frame leaves plenty of room for die set up—provides chute space *under* the press.

VARIABLE SPEED DRIVES are standard on H-P presses so that each job can be run at its most efficient speed.



SQUARE GIBS provide precision fit—no more than a 0.0015" feeler goes between gib and slide, although slide moves freely. Location of gibs close to centerline resists tendency of slide to tilt under off-center loads—slide is held parallel to bed within 0.0005" per foot on all dimensions.



Long runs not essential, users report

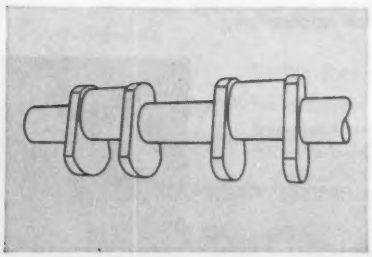
"we set up in 15 minutes, run 3000 parts in another 10..." is typical experience

Consider this: a Bliss H-P Press is usually able to replace from 3 to 12 older and slower presses. And the savings in space, tooling and handling costs alone are often enough to write off the cost of a H-P press.

But the really important saving is in the cost of the parts themselves, because you get so many more so much faster and dies last so much longer.

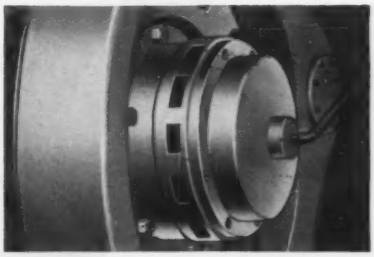
Fast set-up makes that true for both long and short run work. IBM, for example, needs only *eleven* H-P presses to turn out multi-thousand quantities of more than 1500 different parts every three months Their average set-up time: 48 minutes.

H-P presses are available from 12 to 300 tons, non geared or single geared. Special designs, special feeds extend their use to practically all stamping requirements. We'll be glad to send you complete information by return mail.



COUNTERBALANCED to eliminate vibration. Slide and tools are counterbalanced by means of air cylinder in crown. Where top speed of press requires, the crankshaft is dynamically balanced and the throwblock for the feed is balanced by a compensating weight on the feed adjusting screw.

BLISS FEEDS: Bliss makes its *own* single roll, double roll and special feeds to assure accurate feeding at high speeds. Typical of Bliss design is its roll feed clutch—with *eight* or more rollers bearing on *Stellite* inserts in the hub, it gives greater accuracy *longer*.



AIR FRICTION BRAKE AND CLUTCH: Special design gives die setter and operator complete and accurate control of the press. Air pressure can be set so clutch will slip under severe overloads. In addition, this cool-running clutch automatically adjusts itself for wear.

BLISS
SINCE 1857

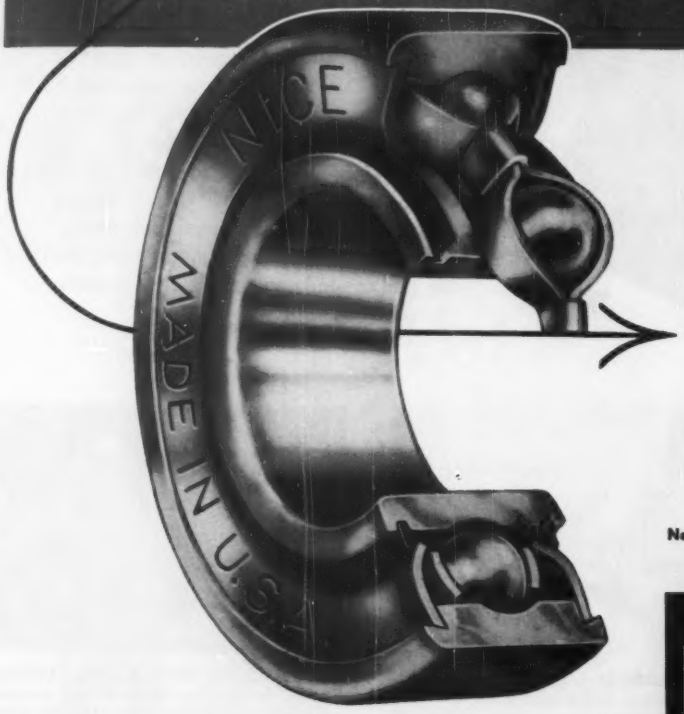
is more than a name...it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pennsylvania. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Pittsburgh, Rochester, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

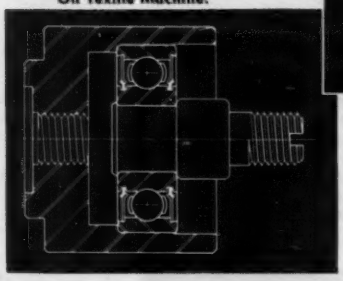
NICE IS THE WORD FOR BEARINGS

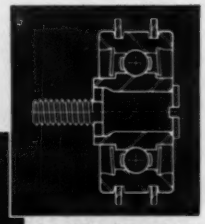


"1600" Series Precision and "3000" Series Unground "Precision Type", Composition Sealed.

The NICE line of ball bearings includes over 750 sizes and types of standard bearings and more than 2500 "specials". This provides a wide range of precision, semi-precision, and unground bearings available to the product designer. If a new "special" is the functional or economic answer to the problem, NICE engineers can design a bearing that will be exactly right for the particular application.

No. 7061 Spindleless Attachment For Spool Winding On Textile Machine.





No. 7069 Tape Guide Roller For Business Machine.

Write for Catalog No. 150

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 263

carbide NEWS

Another WESSON development eliminates grinding, makes tool changes quick and easy

New Precision Boring Tools Use Throw-Away Carbide Inserts

Micro-adjustable boring tools using "throw-away" carbide inserts are the latest in a series of developments pioneered by Wesson in recent months. Aside from eliminating grinding and speeding tool changing and setup, considerable improvement in performance and lower tool cost per piece are major advantages reported from the development.

On the Button

Precision adjustment for diameter of cut is positive and simple. It can be made without removing the tool from the machine since the new Wesson boring tools incorporate a calibrated screw adjustment. The circular dial has 25 graduations, each representing .001-inch. Thus each revolution of the screw is equal to moving the tip in or out .025-inch. Accuracy is assured since the head of the adjusting screw is always pulled up and locked positively against a locating face.

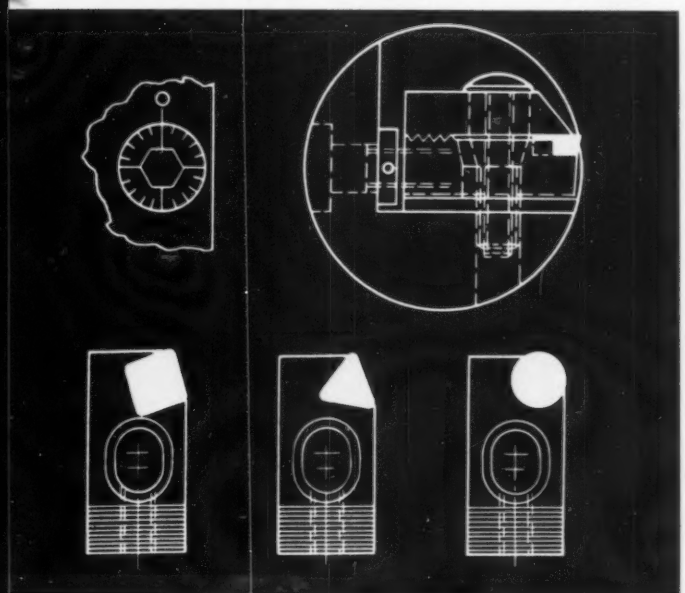
Among striking features is an adjustable built-in chip breaker that also serves as the clamp for the tip.

Versatility Too

Round, square or triangular inserts can be used with only minor parts changes. All parts of any one size of boring tool are identical except for the tip and the anvil-locator in which the tip is mounted.

The new tools are also suitable for internal (American Standard) threading operations using standard Wesson-metal 60° triangular inserts.

For more information on Wesson's micro-adjustable boring tools, write for Data Sheet 8156, or contact your Wesson tool engineer.



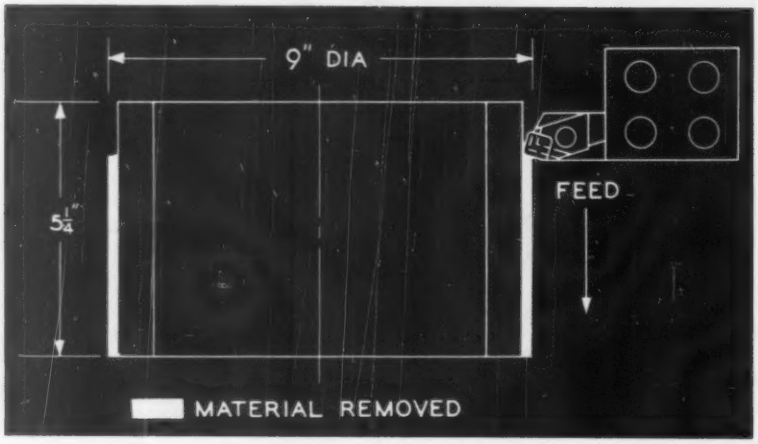
Calibrated-screw (upper left) enables precision adjustment in size of hole being bored to be made right in the machine. Note standardization of parts for interchangeability.

carbide NEWS

Automation Boosts Demand for Special Tools

While automation tends to increase standardization of products, it works the other way when it comes to the tooling used in automated lines. So much so, in fact, that Wesson Multicut Company is erecting a new plant in Brighton, Michigan, just to take care of the skyrocketing demand for its special tools in automated industries. No standard tools will be produced at the new plant. The Multicut plant, shown in the architect's drawing, is the fourth Wesson expansion in the past two years. Previous expansion moves included the new Wesson Metal plant in Lexington, Kentucky, a new Wesson Research Center in Detroit and the new Wesson Cutting Tools, Ltd., plant in Toronto, Canada.

General Purpose Grade Beats Specials on Tough Job



Tough machining jobs don't necessarily call for special carbide grades. Often a general purpose grade will do an even better job. Here is a case in point. The job shown above, was turning the OD of a steel coupling that was unusually tough and scaly. The forgings (low-carbon chrome-moly-vanadium) also had considerable warpage.

Depth of cut, as a result, varied from .070 to .180 inches. This, with all that scale too, caused enough tool breakage to keep output down to around 24 pieces per tool (4 per grind) even though specialized grades were used.

The job was re-tooled with a Wesson Multicut holder using throw-away carbide insert of WESSONMETAL 26—a broad range general purpose steel cutting grade. Output jumped to 100 pieces per cutting edge (800 per insert) with no grinding required.

Tool cost dropped from 48 cents per piece to only 1.4 mills each. In addition, output doubled since WESSONMETAL 26 made it possible to step up both feed and speed on the Gisholt lathe in addition to reducing tool-change downtime.

tools Wesson carbide Wessonmetal
WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO

COST CUTTING IDEAS PROVED IN OTHER SHOPS . . . Have you tried them?

When throw-away inserts are worn on all corners usable for turning, don't throw them away yet. In many operations, it is only the corner that really wears very much, leaving the rest of the insert as good as new. Switch it to a chamfering or facing operation.

• • •

When a part print comes from engineering with drill holes that have a high length to diameter ratio, see whether that ratio can't be reduced. If the ratio is cut in half you may be able to cut tool costs 80%. Tool costs go up much faster than depth of hole if diameter stays the same.

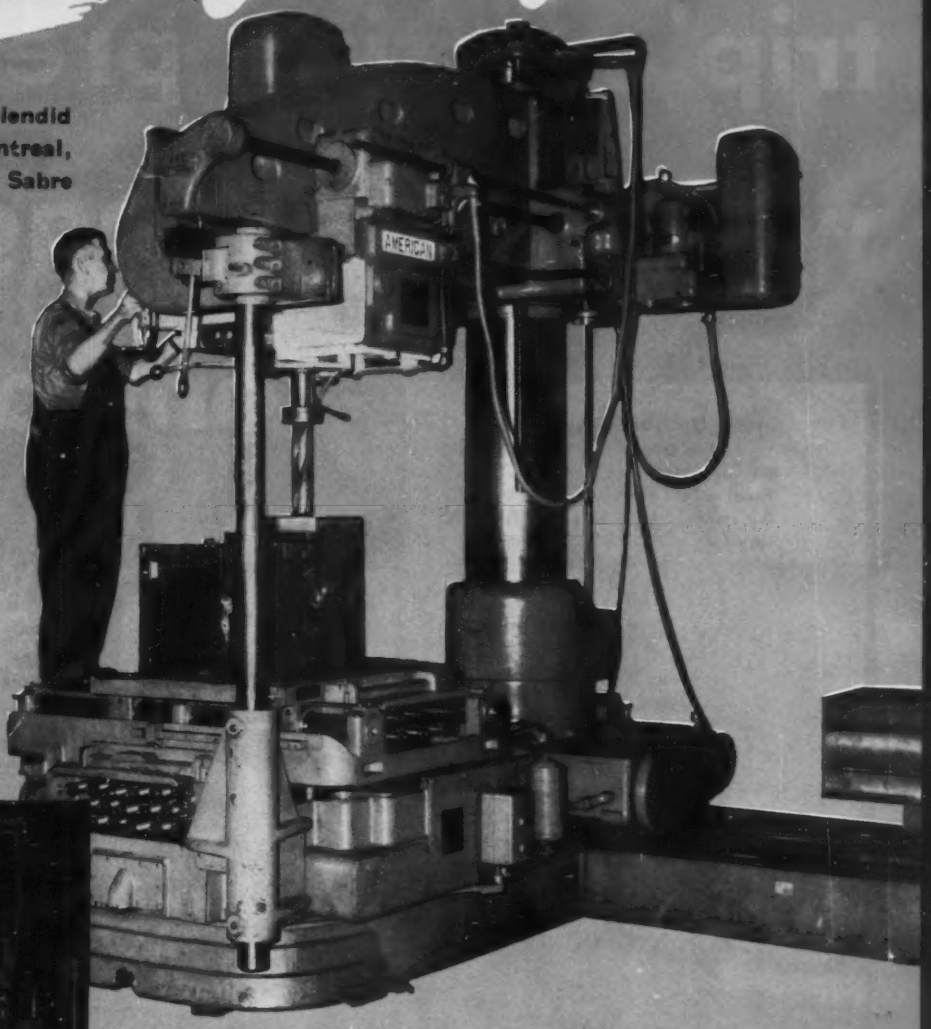
• • •

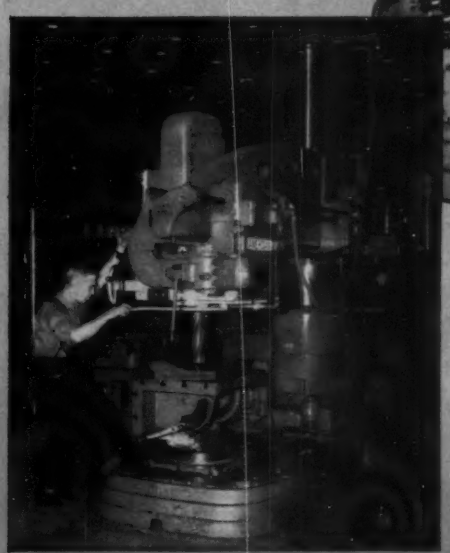
Don't assume that you've done a job on tool costs when you've cut the cost in half on a particular operation. Wesson engineers, time and again, have been able to help cut costs still further by on-the-job, in-the-shop engineering application.

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.





This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

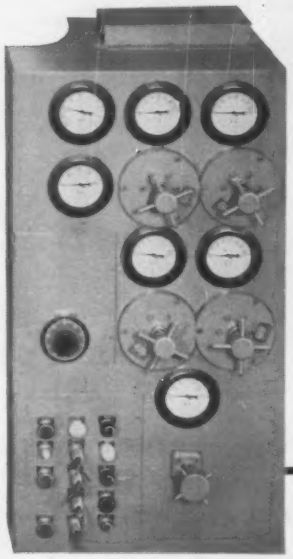
For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Farquhar... the first triple-acting press with electric magnetic controls...

EVERY ADJUSTMENT of speed, timing and pressure is made by the operator on this Control Panel without leaving his operating station. It is no longer necessary for him to climb to the top of the press for this purpose.



...the only press that can do so many things so well

THIS hydraulic press revolutionizes the high speed production of draw-formed parts. We believe that it has rendered obsolete every double-acting and triple-acting press now in service. These are challenging statements... *but read the facts.*

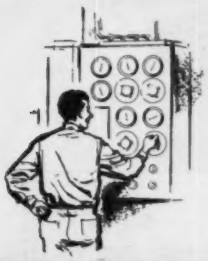
A. B. Farquhar Division, The Oliver Corporation
Press Department, York 43, Pennsylvania

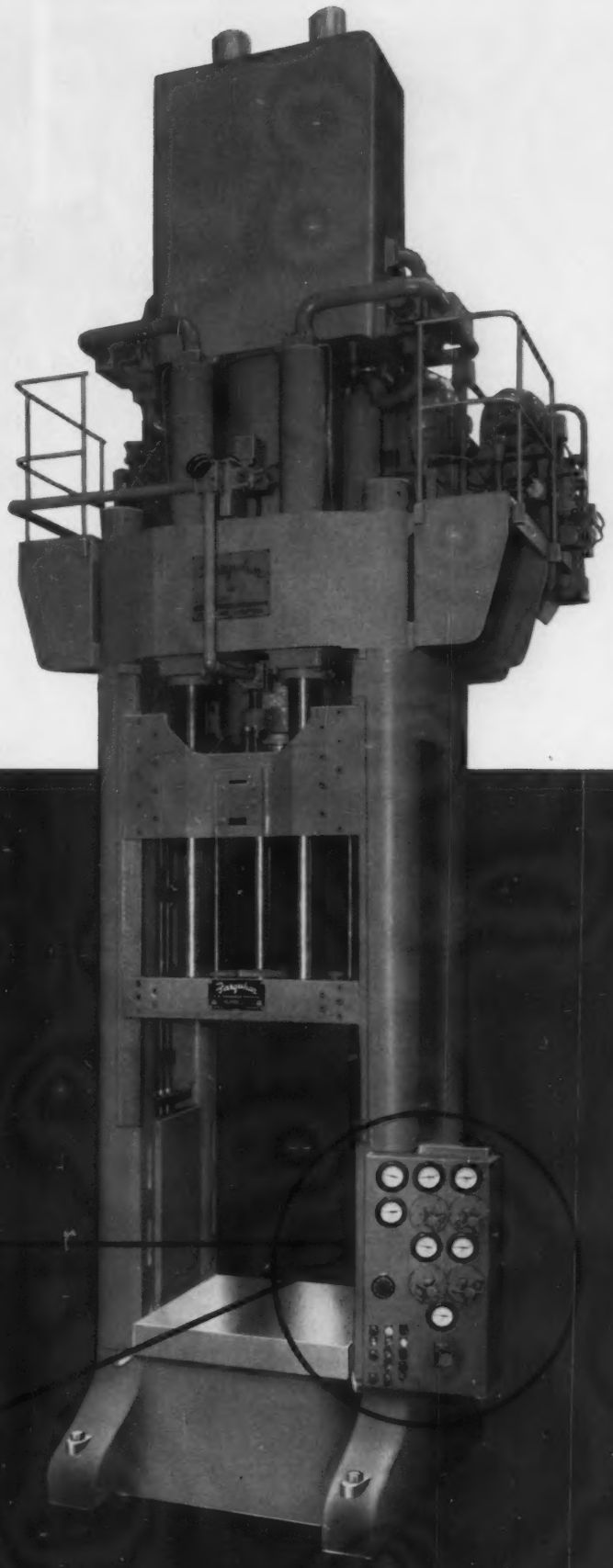
OLIVER

Farquhar PRESSES

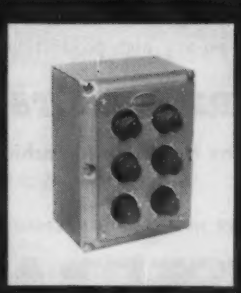
DRAWING • FORMING • FORGING • STRAIGHTENING • BENDING

- **Unlimited speed changes** now possible at any point in the cycle. This means, for example, that the ram can approach the draw at maximum speed, slow down as it enters the draw, change speed in the middle of the draw, strip slowly and return to up position at maximum speed.
- **Draw-forming of difficult materials** is thereby greatly simplified and improved. The exact speed can be selected which is best suited to the characteristics of the material at any point in the stroke.
- **Expensive dies** can be given added protection by "gentle" treatment at point of contact and withdrawal.
- **Cycle time is greatly reduced,** because maximum speeds can be attained at every desired point in the cycle.
- **No expensive cams** with time-consuming adjustments are needed to obtain these results. All speed changes are made by dial settings on the control panel.



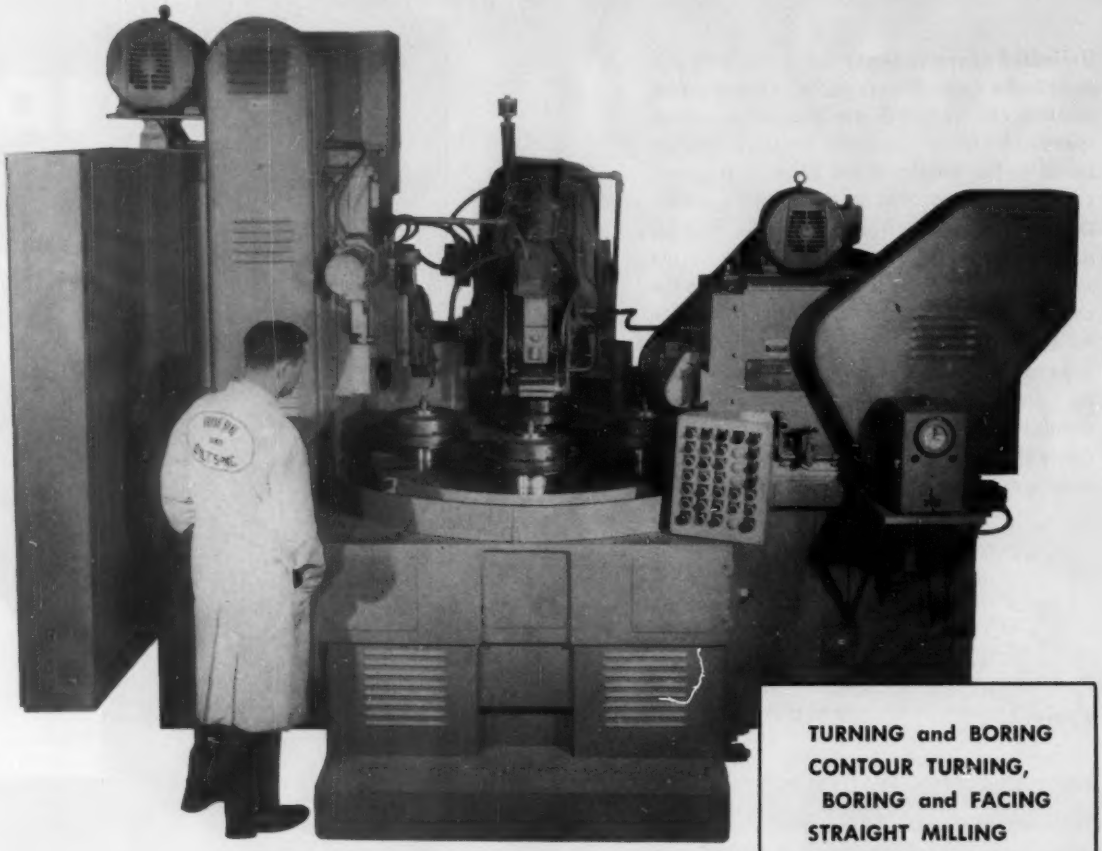


- **4-point adjustment of blank holder pressure** is made by operator without leaving operating station, an important device in the draw-forming of eccentric shapes. This has been a feature of Farquhar Double-Acting Presses in the past. It is an important feature of the new Farquhar Double and Triple-Acting Presses, too.
- **Best of all,** with these additional advantages, the Farquhar Double and Triple-Acting Presses are competitively priced!
- **For a more complete description** of these new Farquhar Presses with electric magnetic controls, write for Bulletin A-200. Please use your company stationery. A. B. Farquhar Division, The Oliver Corporation.



Speeds are pre-set by these radio-type dials which can be located within the main control panel or in a remote position.

FORCING • ASSEMBLING • EXTRUDING • AND OTHER OPERATIONS



TURNING and BORING
CONTOUR TURNING, BORING and FACING
STRAIGHT MILLING
CONTOUR MILLING
PLANETARY MILLING
I. D. GRINDING
O. D. GRINDING
SURFACE GRINDING
SURFACE HONING

You can combine these finishing operations on one Hoern & Dilts indexing finishing machine →

Indexing Table: Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, *both ends* of a piece may be put through identical or closely related operations.

Heads: Individually cam-actuated heads, each designed for a specific type of operation which may be performed vertically or horizontally as required. Heads self-contained, with individual electrical, pneumatic and lubricating systems.

Speeds: One over-all speed may be used, or a different speed at each station. Spindles may be stopped and locked in any predetermined position at any station.

Feeds: Individually adjustable for each head.

Grinding Operations: Wheels dressed and compensated during index.

Automatic Gauging and feedback adjustment available at all stations.

A Hoern & Dilts Indexing Finishing Machine handles with *one* chucking and one operator, the operations ordinarily performed by several operators using completely different types of equipment.

This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company
Saginaw, Michigan

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS:

New Britain-Gridley Machine Division
New Britain, Connecticut
Automatic Bar and Chucking Machines
Precision Boring Machines and
New Britain +GF+ Turning Lathes

Lucas Machine Division
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

For more information fill in page number on Inquiry Card, on page 263

SPIRAL BEVEL GEAR

HYPOID PINION

How to produce both with just *one* cutter, *one* machine

These two parts alone show why the Unitool* Method is ideal for economical job shop operation, for trying new ratios, and for producing prototypes.

You need only one machine—either the No. 116 Hypoid Generator or the smaller No. 106—and one cutter to produce both parts.

You complete both parts from the solid before removing them from the machine.

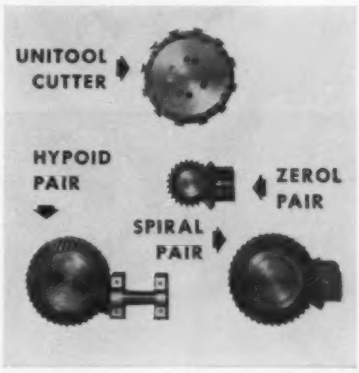
Add just five more cutters and you are equipped to produce spiral bevel and Zerol® bevel pairs of any ratio, and hypoid pairs of 3:1 ratio and higher. You can cut any of these gears up to 18″ pitch diameter.

*Trademark

No special training needed The operator uses direct common sense methods to set for the correct tooth thickness and position of contact. No lengthy, expensive training is necessary.

Fast change-overs You can switch to different sizes or types of gears in minutes. A calculated set-over is all it takes to get the right gear size. No other measurements are necessary.

Bulletins—Write for bulletins on the Unitool Method and the two generators which outline all the advantages of the method and explain its operation in detail.



With the Unitool Method you use just one cutter to produce the three types of gear pairs shown here. Such versatility cuts costs sharply on small-lot production.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

are you running hard...

Conservative studies of growth potentials and long range trends, by both industry and government, show clearly that markets are already outrunning the labor supply for industrial production. The pace will get increasingly faster as our growing population demands more goods and services.

Those companies which stay in the race will do so by stepping up their productivity per man hour, and planning their capital expenditures accordingly. They will not stumble over the problem of machines displacing men, because they know there will not be enough labor to fill all the jobs created in the next ten years.

Avey production machines have already increased productivity per man hour, per square foot of plant space, and per dollar of invested capital in many plants. Their fast rate of return makes it profitable and pleasant to stay in the running.

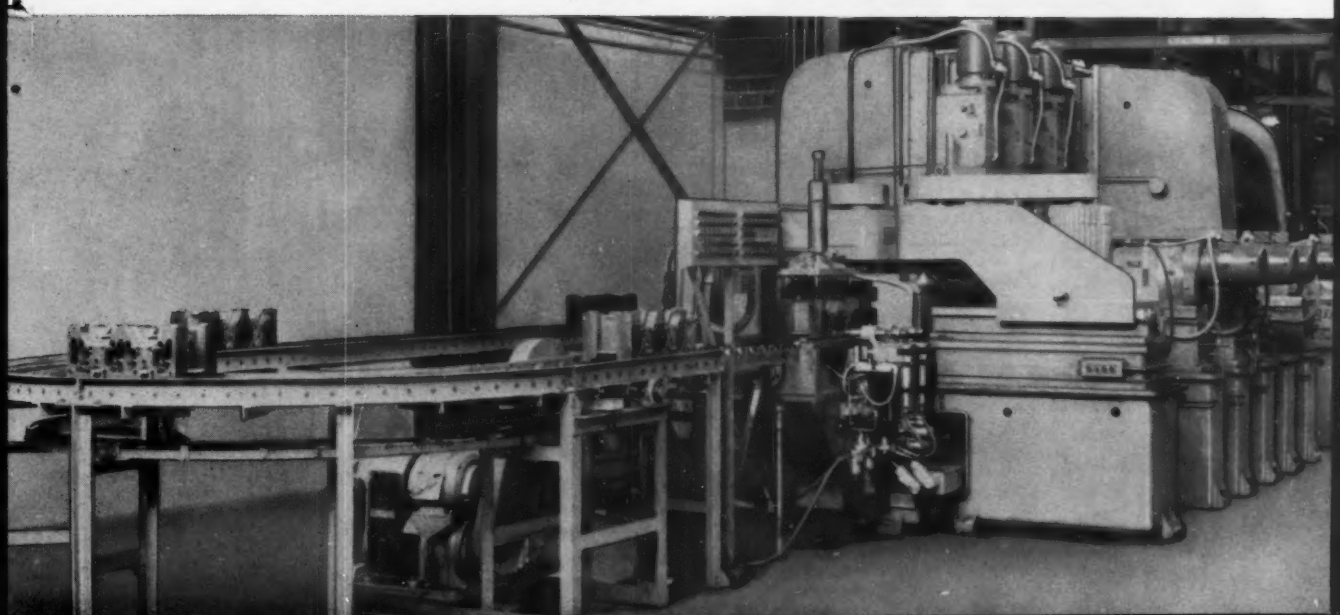
▸ **production data:** This machine automatically rough and finish mills, drills, countersinks, and taps 360 hydraulic pump covers per hour. Operations include automatic gauging, probing, and insertion of bronze bushing in bore.

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

and losing ground?

Avey



When steel is 3 times stronger than iron . . .

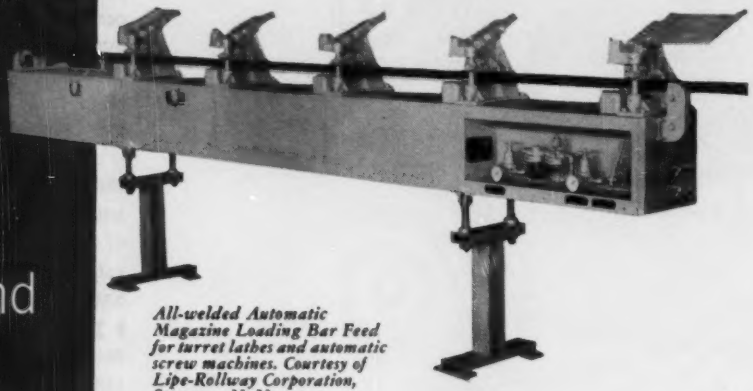
Has two and one-half times the rigidity . . .

Yet costs a third as much per pound . . .

WHY

aren't more of your products designed for welded steel?

NOW IT'S WELDED



All-welded Automatic Magazine Loading Bar Feed for turret lathes and automatic screw machines. Courtesy of Lipe-Rollway Corporation, Syracuse, N. Y.

to save cost of manufacture . . . hold closer alignment

HOLDING precision alignment against the whip of bar stock was the problem. Welded steel design was the answer because:

1. With steel's greater rigidity, an efficient, sturdy yet lightweight bar feed could be designed to withstand the impact of bar stock running at high spindle speeds.

2. Fabrication was easier since the design could be built from simple angles, channels, I beams and plate.

3. Overall cost was less than using gray iron construction.

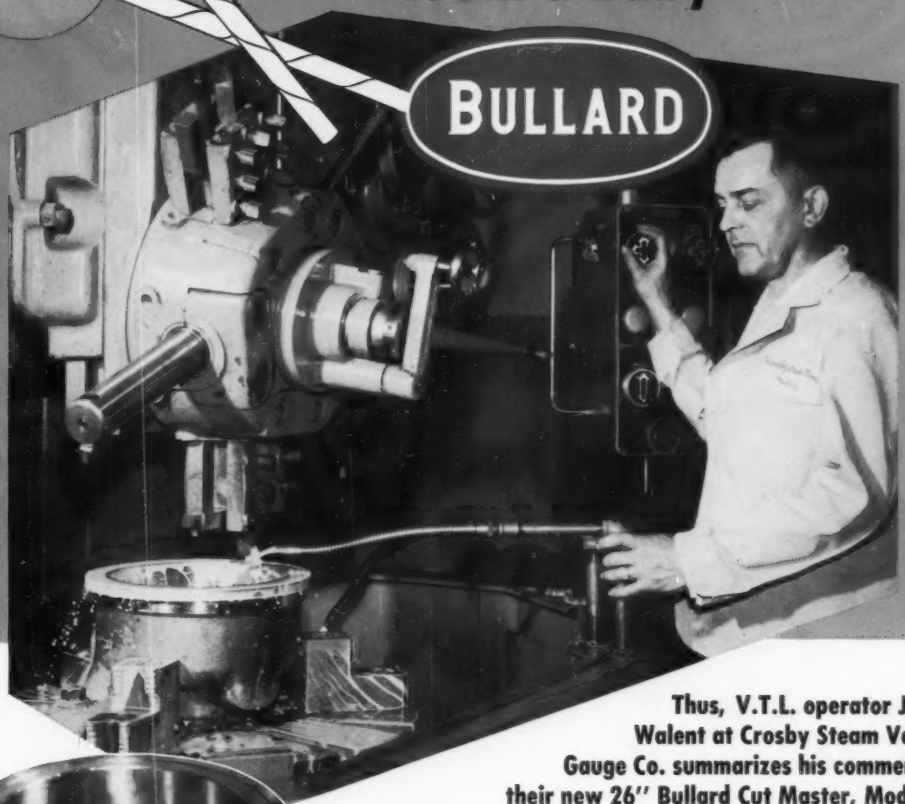
These benefits of welded steel can help you solve many of your design problems today and cut costs besides. Let Lincoln show you how. Write . . .

THE LINCOLN ELECTRIC COMPANY
Dept. 1215 Cleveland 17, Ohio

Creating Lower Costs For Industry . . .
With Welded Design

For more information fill in page number on Inquiry Card, on page 263

"Running this CUT MASTER is as easy as taking candy from a baby"



Thus, V.T.L. operator Joseph Walent at Crosby Steam Valve & Gauge Co. summarizes his comments on their new 26" Bullard Cut Master, Model 75.

"With the movable Pendant Control I can work from the most advantageous position. You'd be surprised how much easier the Pendant Control makes it for me. It increases my production too, to have all the controls in one spot — no running back and forth from one control to another." This feature of the new line of Bullard Cut Master, Model 75 is only one of many reasons why you should have them in your plant.

Why not get the full story — ask for a catalog by calling your nearest Bullard Sales Office, Distributor or write

THE BULLARD COMPANY
BRIDGEPORT 9, CONN.

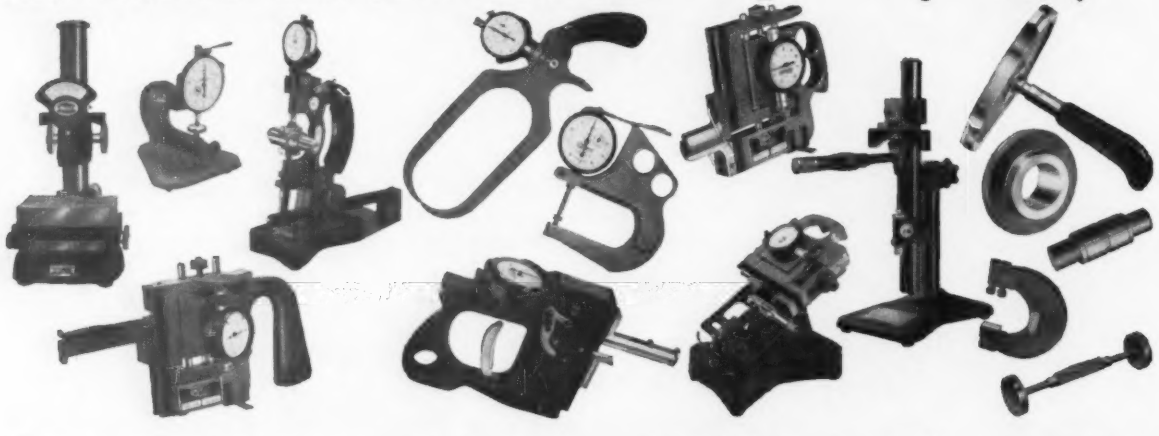
WHATEVER you need in mechanical gages

Consult STANDARD First

IT'S a great advantage to work with a firm that presents a complete line . . . to deal with gage makers who understand your problems . . . to get the one gage *just right* for *your* job. Whether you work from our catalog or consult with us, you are assured the finest available instruments for your particular needs.

GAGES are our only product. To you, that means the benefit of over 30 years concentrated knowledge and experience. It also means wide selection, progressive design and time-and-money-saving innovations. For instance: Dializer® for converting ordinary snap gages to dial snap gages; DuBo® plug gage which tells more, more easily; Versa Dial® basic dial unit for a host of applications. These are some of the reasons *it pays* to *standardize* on STANDARD. Your inquiries are invited.

Send for Catalog



STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

112 PARKER AVE. POUGHKEEPSIE, N. Y.

STANDARD Gages

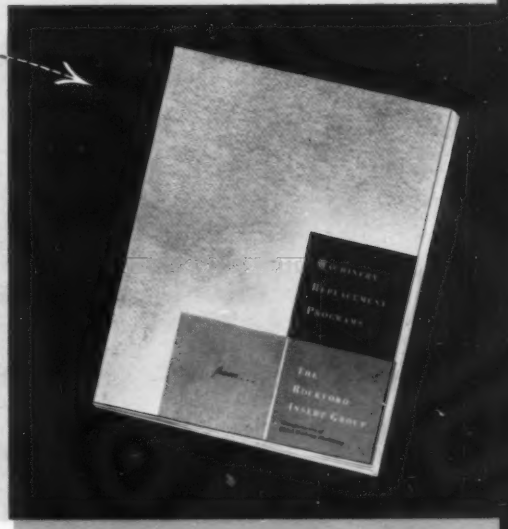
"We have now initiated action at our Hammond Division in Hammond, Indiana, for applying the MAPI replacement formula as guidance in all capital acquisitions that develop. This has met with much success and is accompanied with anticipation that the plan will eventually be expanded to include a systematic program of company overall equipment analysis."

L. D. McDOWELL
Chief Works Engineer

How AMERICAN STEEL FOUNDRIES is initiating machinery replacement programs in their multi-plant operations

read what other prominent manufacturers have done

For your copy of this booklet, merely write to any one of the companies in the Rockford insert group.



Keep gathering metal-working production ideas . . . be well informed when you replace machinery

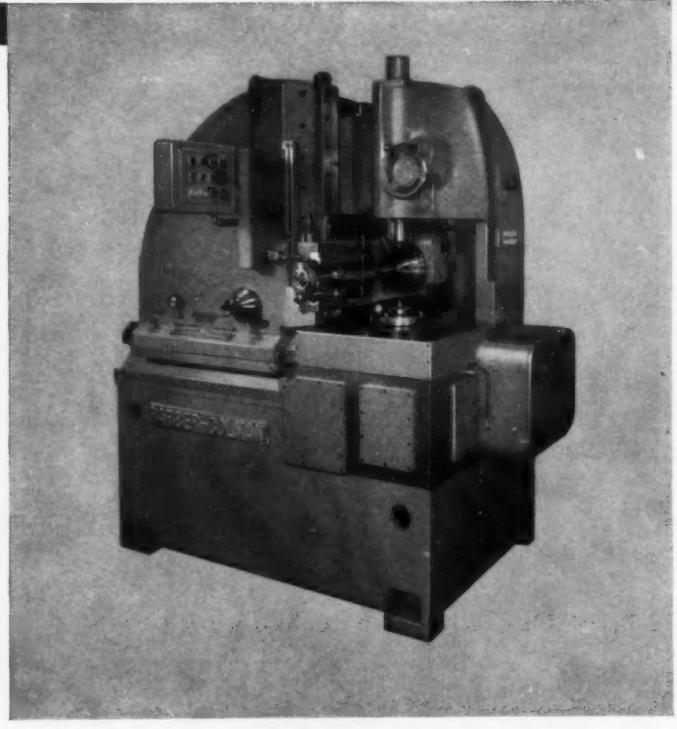
Rockford Insert Group

October, 1956

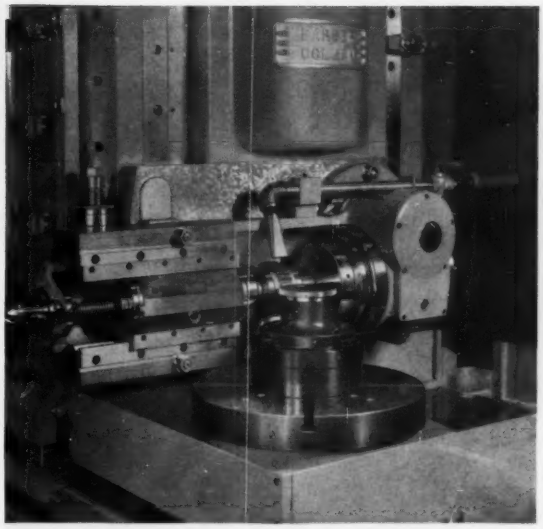
a new concept of gear accuracy!

Barber • Colman Builds World's Most Accurate Hobbing Machine

First hobbing machine ever guaranteed to cut gears within 10 seconds angular error



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Barber-Colman has designed and built, in collaboration with Sperry Gyroscope engineers, a new type of hobbing machine which hobs without any further finishing operation, gears for the most accurate radar, navigational and computing equipment. This machine is known as the "Ultracision" Hobbing Machine and is so accurate that gears cut by it will transmit motion within 10 seconds of true angular rotation. This is equivalent to .0001" on 4" diameter, which is the only size that has been thoroughly investigated at the present time. This means that the combination of lead, profile and spacing errors measured over non-adjacent teeth cannot exceed 10 seconds of true angular displacement at any diameter along the involute.

In order to arrive at this degree of precision, it has been necessary to provide new methods of positively checking such accuracy. Sperry engineers utilize theodolites and auto-collimators in conjunction with pneumatic, electronic and mechanical gaging equipment which assures accurate measurement within millionths of an inch.

the machine

To produce gears of this accuracy, many new and unusual features have been incorporated in the hobbing machine. The greatest care in manufacture and assembly has been used for all parts. All vital surfaces on the machine are scraped within .0001" per foot, and even the covers are scraped to fit the scraped portions of the bed casting to prevent entry of foreign matter.

Since the machine is designed to cut only spur gears, the feed drive is independent of the main drive. Capacity of the machine is 10" diameter blanks, 6" maximum length of hob carriage travel, and maximum rated pitch capacity of 32 DP. Drives to the work and hob spindles have been made as short as possible to minimize any twisting and vibration. An extremely accurate index worm and gear are mounted in ultra-precision taper roller bearings. Except for the index change gears, the gear train between the main drive shaft and the index worm contains only a worm and worm gear, and a pair of 90° helical gears.

The basic machine weighs 11,000 lbs., (with controls 13,800 lbs.) to provide the rigidity necessary for this exceptional accuracy. Another feature for increased rigidity and accuracy is the elimination of a hob slide. The hob is mounted directly on an expanding arbor, and shifted on this arbor, rather than by means of a hob slide.

Adjustments are provided for trueing the hob spindle within a few millionths of an inch. Both hob spindle and outboard support are mounted in ultra-precision taper roller bearings.

the hobs

To attain extreme profile accuracy on the gear teeth, Barber-Colman also has developed a new class of hob called "Ultracision", and made to limits of .00008" lead variation in one axial pitch, and .00015" in 3 axial pitches. These limits are just half of those for Class AA hobs. These hobs are ground and have larger than standard diameters to permit a greater number of hob teeth for very fine finish on the gear tooth profiles. Wide hubs and a 2" diameter straight bore provide maximum rigidity for the hob.

The development of this new concept in gear accuracy — the finest limits of gear accuracy ever obtained on a production basis — will eventually reflect in a higher standard of quality for gears produced on standard production hobbing machines. You are invited to submit your gear specifications and problems for analysis and recommendations by our engineers. Detailed information on the new "Ultracision" Hobbing Machine is available on request.

BARBER-COLMAN COMPANY

6210 ROCK STREET • ROCKFORD, ILLINOIS

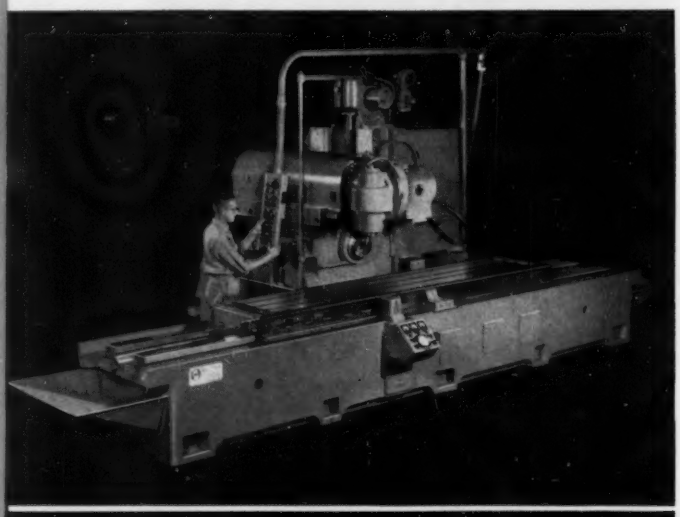
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

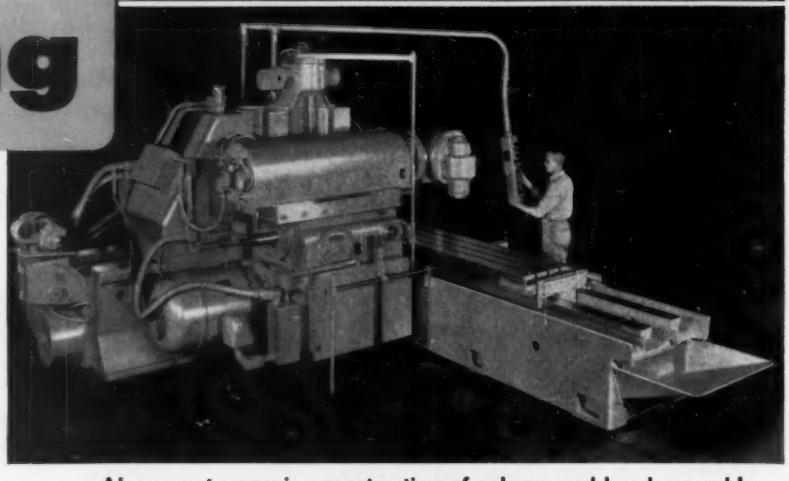
BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

HERE'S new ALL-ANGLE Power IN Milling

Below, front view of machine showing operator's position.





Above, note massive construction of column and head assembly.

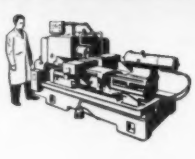
NEW Sundstrand Universal Bed-Type Milling Machine has rigidity and power for wide range of cuts

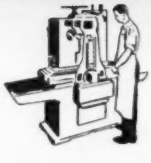
If you want to get a lot of milling done on one machine, get the facts on this new Sundstrand Rigidmil. For instance, it has both a horizontal spindle head and an all angle ram type head.

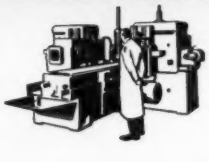
Twenty-four possible speed changes are available on both heads in a range from 14 to 1540 RPM with changes made from a selector switch on the control pendant. With the main spindle the HP range is 1 HP per RPM up to 50 HP max. and with the all angle head ½ HP per RPM up to 20 HP max. The flexibility of this machine in taking a wide range of cuts at all angles is illustrated on the opposite page. If you want a lot of milling from one machine, check into this new Sundstrand Rigidmil.

SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

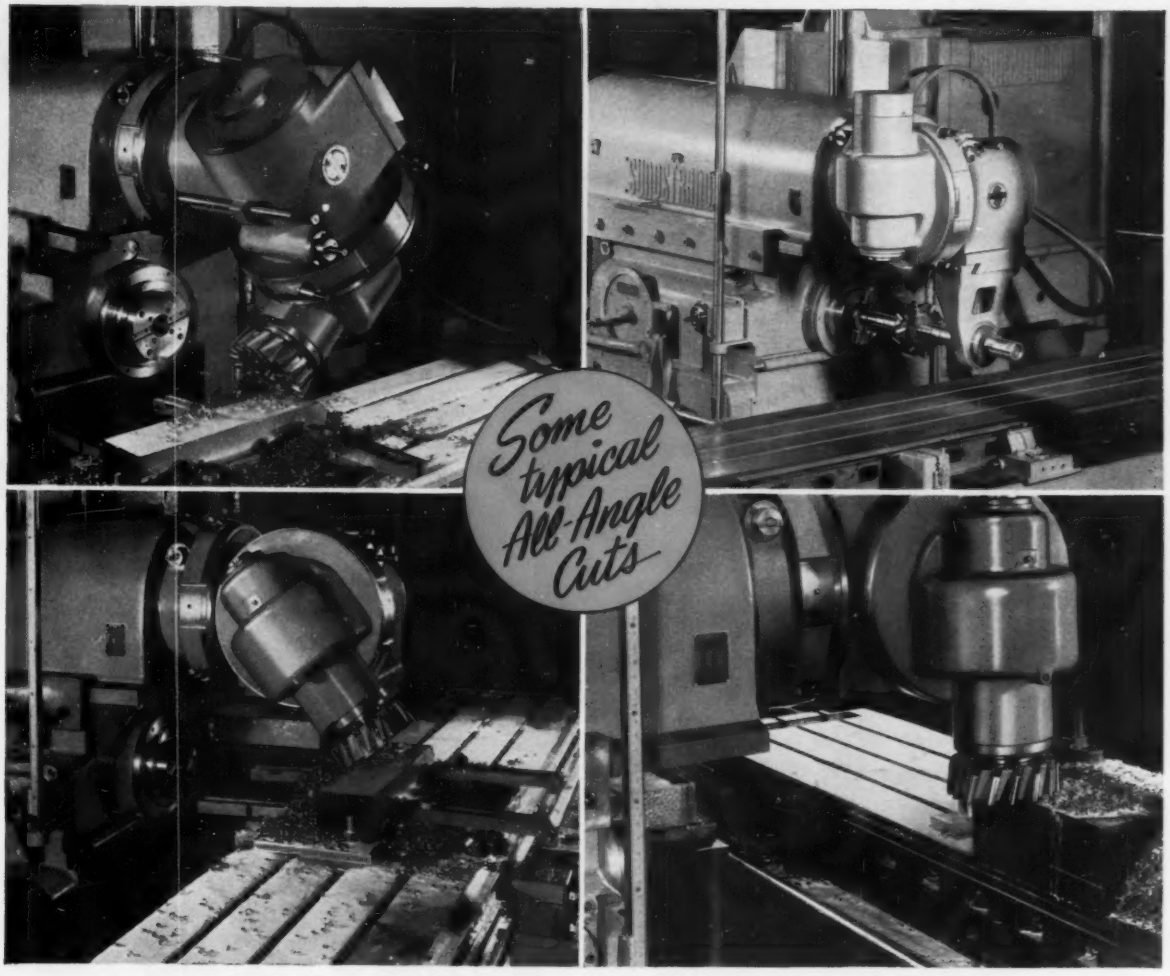






Below, angle cutting using cross feed of column.

Below, main spindle with arbor support for gang or slab milling.



Above, angular milling using longitudinal feed of table.

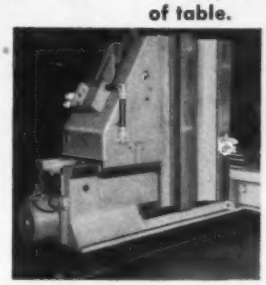
Above, vertical face milling using longitudinal feed of table.

FEATURES

Here are only a few of the many features of this heavy duty all-angle Rigidmil.

1. Heavy column, illustrated, has third way for support of head ways.

2. Scales and verniers provided for column, head and table positioning.



3. All-angle head has dovetail mounting surfaces for supports for arbor milling.

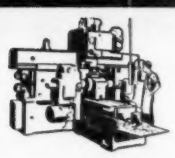
4. Meters are provided to indicate per cent of full load current on spindle motor and all feed rates.

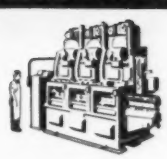
5. Machine is controlled from a single suspended pendant with selector switches to operate all machine movements and speed and feed selection.

6. Machine can be furnished with table widths of 24", 30" or 38" and table feed stroke up to 216".

Additional Data will be sent upon request, write today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

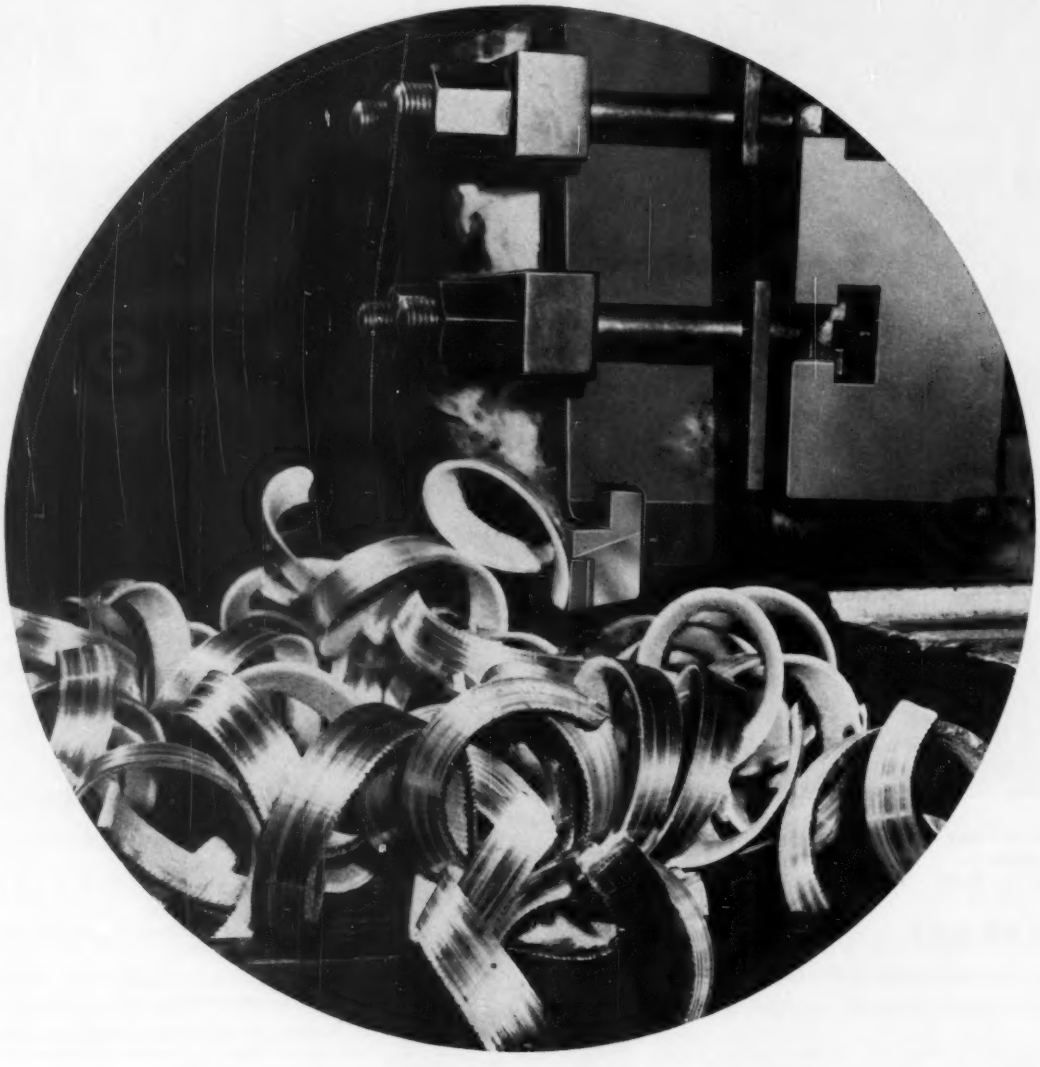




SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

speeds for carbides **plus** heavy-cut efficiency



low range to 100 fpm . . . for extreme depths of cut and maximum feeds

medium range to 150 fpm . . . for average cuts in medium steel or cast iron

high range to 300 fpm . . . for carbide planing of steel and non-ferrous metals

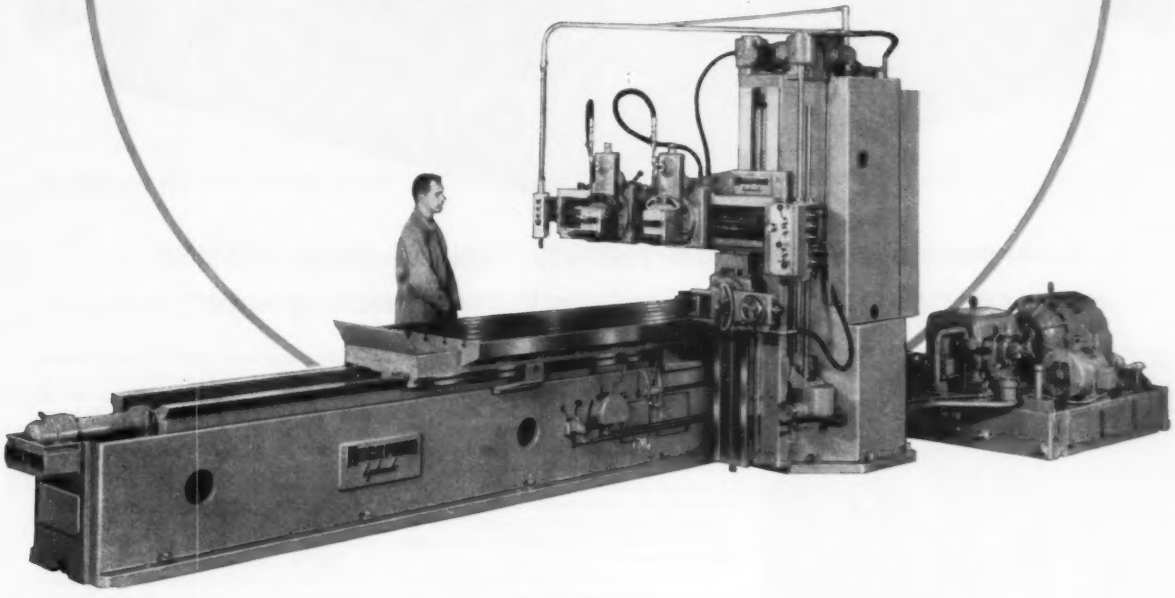
CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

with triple circuit h3 drive

The new heavy duty Model OGN Hydraulic Shaper-Planers are equipped with triple circuit h3 drive to combine the ruggedness and cutting efficiency of single circuit planers, with the speeds required for carbide planing. Three distinct ranges of cutting speed are provided, with power inversely proportional, to give the correct combination of speed and force to most economically machine any metal.

Hydraulic drive is ideally suited for carbide tooling, since optimum cutting speeds can instantly be set for any tool. Tools also enter the cut more smoothly with hydraulic drive to reduce the tendency for fracturing brittle carbide tips.

A Rockford Machine Tool Co. representative can demonstrate these advantages for you. Ask your local dealer for full details, or write us for a copy of Bulletin No. 1200.



ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

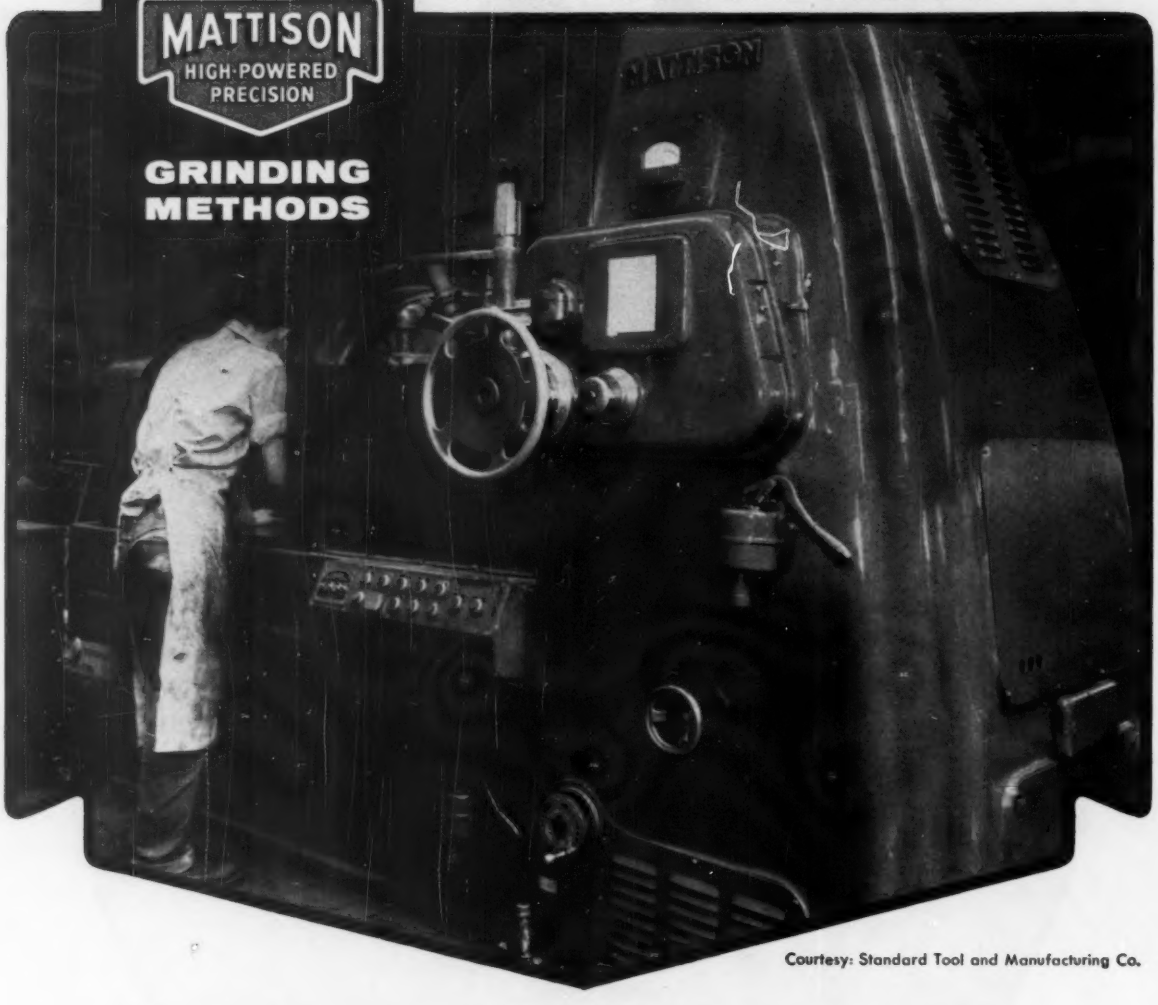
h HYDRAULIC

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 28—CONTRACT MACHINE WORK

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS



Courtesy: Standard Tool and Manufacturing Co.

Increase production 28%, accuracy 25% . . . grinding variety of subcontract parts!

This 12 in. square record mold of forged steel is finish ground to flatness within .001 in.

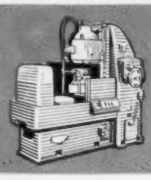
Low cost, precision production is the secret of success of any subcontract shop. Standard Tool and Manufacturing Co. of Arlington, N. J., discovered that a Mattison No. 36 Rotary Surface Grinder made this production possible. A job shop that turns out parts ranging from tiny inserts for television tubes to components of heavy-duty machinery, Standard has increased production 28 per cent and accuracy 25 per cent, with the Mattison.

Standard feels the Mattison permits a much wider range of work with improved finish, flatness, and parallelism. Larger workpieces can be handled, the ease of setup, and power and rigidity of the machine mean a significant increase in production.

A typical job at Standard was a set of record molds of rough-faced steel forgings. Two parts, both 12 in. square, are ground. The top section is ground from .500 in. in thickness to .375 in. and the bottom section from 1.275 in. to 1.150 in. After the sections are brazed, they are finish ground to remove warpage. Flatness is held within .001 in.

Mattison's No. 36 can now be equipped with automatic sizing and cycling to coordinate with the new continuous down feed, to boost production and increase precision. See your Mattison machinery dealer now to get all the facts.

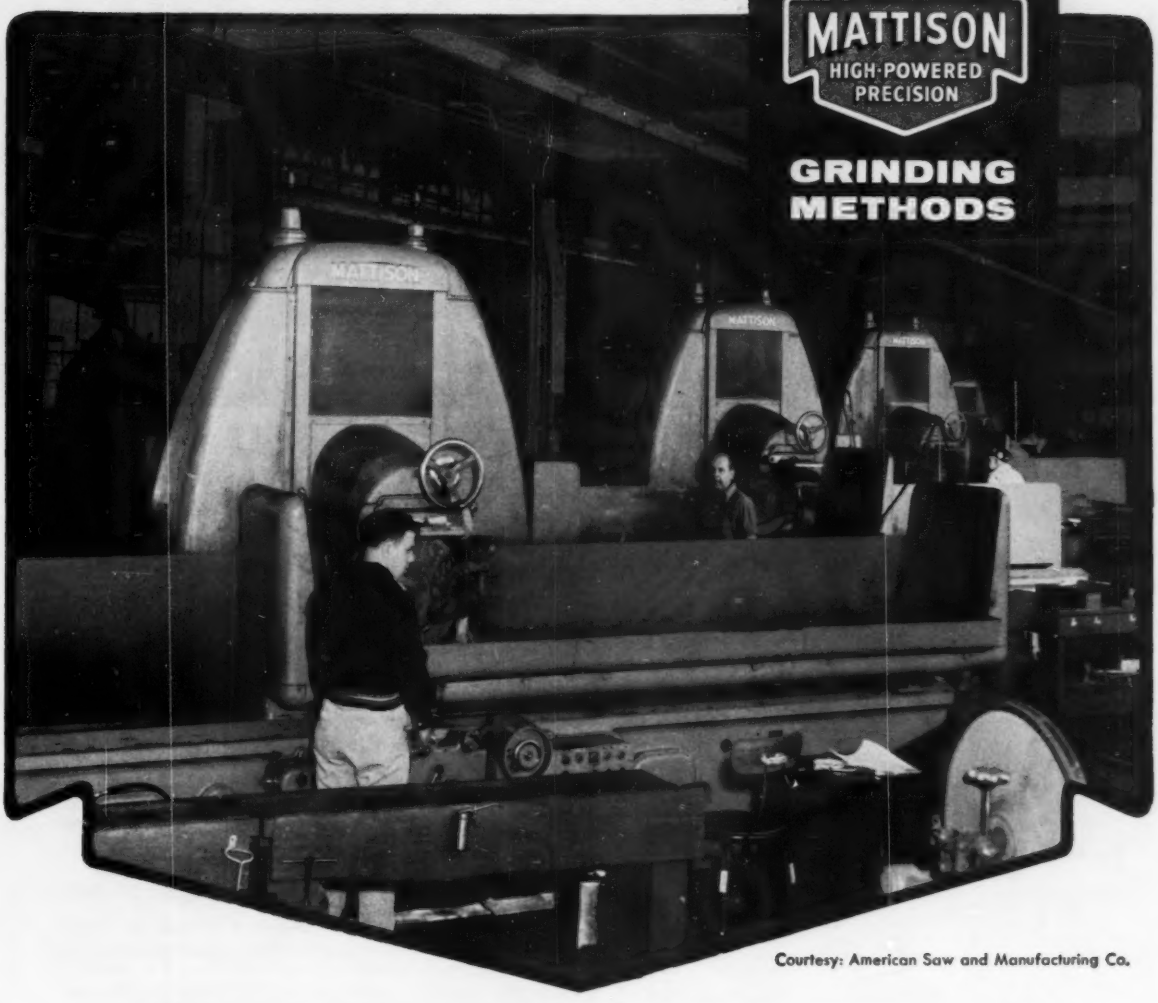
IF IT'S A FLAT SURFACE
THERE IS A MATTISON
TO GRIND IT



CASE HISTORY NO. 29—PRECISION GROUND FLAT STOCK

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Courtesy: American Saw and Manufacturing Co.

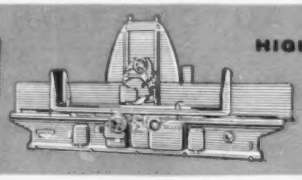
Battery of five Mattison surface grinders speeds production of precision-ground tool steel

American Saw and Manufacturing Co., of East Longmeadow, Mass., uses a battery of five Mattison High-Power Precision Surface Grinders to grind annealed tool steel ground flat stock on a high production basis. This precision product is used to make jigs, fixtures, punches, dies, templates, gauges, etc., and consistent quality means sizable savings for tool and die makers. American produces fine finish stock on which thickness is held to within .001 in.

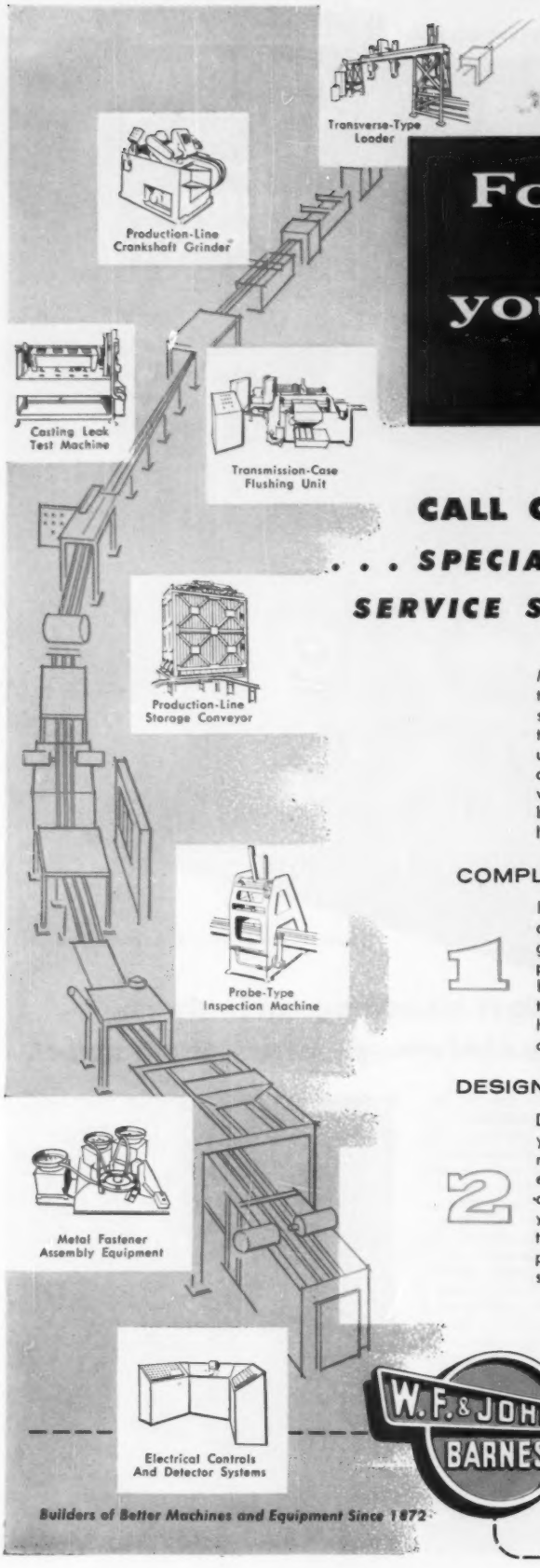
Mattison has designed the High-Power Precision Surface Grinder with the ability to hog off stock, where required, and still maintain precision and fine finish. An outstanding feature of these machines is the massive, double-column support unit which is assembled as an integral part of the base. The vertical columns, with wide bearing surfaces on the inside face and dovetail bearing surfaces on the front and back of each column, provide an eight-surface support for the wheel slide assembly. Precision production is further assured by the powerful built-in motor mounted directly on the wheel spindle. This positive, direct drive eliminates vibration and increases usable power. See your Mattison machinery dealer about putting the *"power-designed"* machine to work cutting costs and upgrading quality in your shop!

Mattison grinds annealed tool steel with precision, on a high production basis at American Saw.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.



HIGH-POWERED PRECISION SURFACE GRINDERS



For a practical solution to your automation problems....

CALL ON W. F. & JOHN BARNES

. . . SPECIAL TWO-FOLD COORDINATED SERVICE SOLVES PROBLEMS QUICKLY

More and more production executives than ever before are today turning to Barnes for help in designing and building specialized automation equipment. With 80 years of practical machine building experience, Barnes have been called upon to design and build hundreds of different types of automatic handling and special processing equipment as well as special high production machine tools. Now, to better serve demands and help you solve automation problems quickly, Barnes offers a two-fold coordinated service:

COMPLETE PRODUCTION-LINE ENGINEERING

1

If you are planning new production-line methods for either automatic or semi-automatic operations, an experienced engineering staff is available to work with you. The detailed plans and proposals submitted for your consideration can be depended upon to provide you with the latest in automation engineering and the very best of proven mechanical, hydraulic, and electrical actuation. Ask for a free survey of your problems early in your planning program.

DESIGNING & BUILDING SPECIALIZED UNITS

2

Designing and building specialized, individual units to suit your specific needs is a separate, additional service. Where required, electrical, mechanical, hydraulic, fixture, and tool engineers work together as a team. All efforts are closely coordinated with complete manufacturing facilities to save you time and eliminate divided responsibility. As illustrated, this service covers hundreds of different types of automatic processing and work-handling units that are today profitably serving a wide range of industrial needs.

ANALYSIS OF METHODS — Call on Barnes engineers today for a practical solution to your automation problems. Or, ask for an analysis without obligation.

W. F. & JOHN BARNES

Builders of Better Machines and Equipment Since 1872

AUTOMATION SECTION

416 S. WATER ST. • ROCKFORD, ILLINOIS

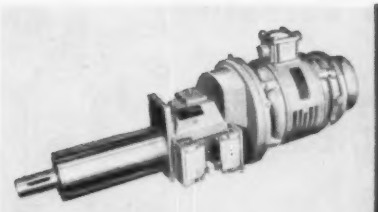
SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

R-J UNITS

DRILL
TAP
INDEX
SCREW FEED

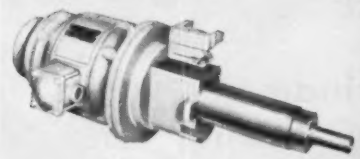
FOR BUILDING OR REBUILDING YOUR OWN MACHINES



DRILL UNITS

VERSATILE, EASY TO INSTALL

Made in 3 models, with overall range from ¾ to 5 h.p. Spindle speeds from 200 to 2400 r.p.m. Cam feed controls all cycle elements as required. Mounting is straight bored hole with flange bolts. Will drive multiple-spindle head. Made to J.I.C. standards or with direct drive.



TAP UNITS

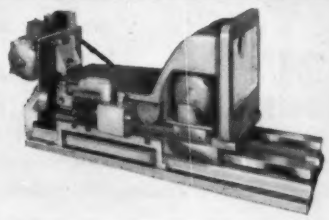
ACCURATE, STURDY, SIMPLE

Completely self-contained, with accurate, interchangeable lead screw and lead nut feed. Made in 3 models, with overall range from ¾ to 5 h.p. Spindle speed ranges from 100 to 1300 r.p.m., varying with different units. Mounting is straight bored hole with flange bolts. Can be arranged to drive multiple-spindle heads. Made to J.I.C. standards or with direct drive.

INDEX UNITS

RUGGED, SELF-CONTAINED

"Rim-Ball" construction, a heavy-duty bearing just inside edge of table all around, enables unit to support and easily rotate pieces of great weight. Belted or direct-drive index motor with brake. Modified geneva-type motion. Made in 8 sizes from 16" to 54" diameter, index positions from 3 to 12 inclusive. Flat surface mounting. Can be mounted vertically.



SCREW FEED UNITS

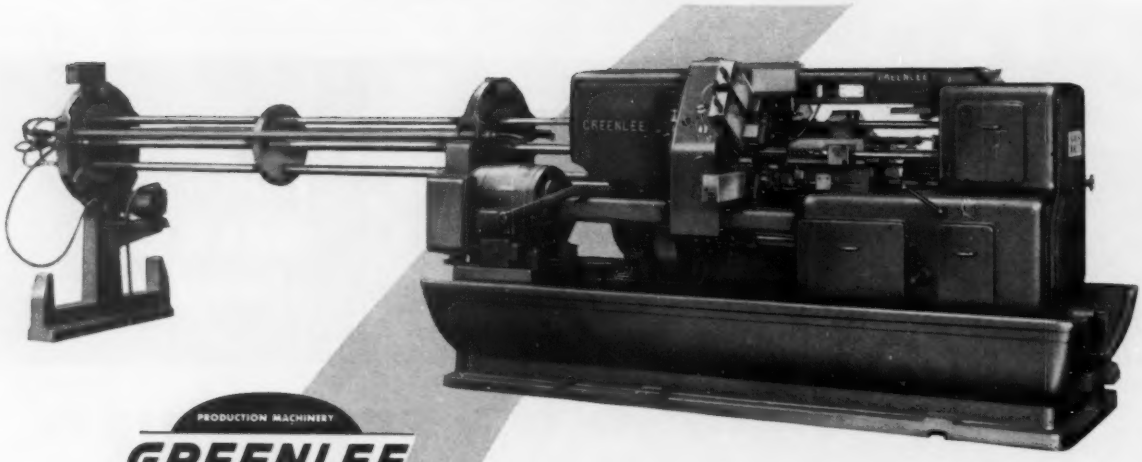
POWERFUL, ALL-MECHANICAL

Two-motor differential drive of feed screw and nut provides wide range and variety of feeds, working and rapid traverse, forward and return, which can be adjusted easily and quickly. Will take spindle drive motors up to 25 h.p. All-mechanical and completely self-contained for simple installation and easy maintenance. Fully assembled and tested. Made to J.I.C. standards.

REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS

R-J

DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS



PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

1. Permits Greater Job Versatility
2. Easily Adapted to Multiple Feedouts
3. Provides Longer Stock Feedout
4. Eliminates Stock Scoring
5. Reduces Stock Reel Noise
6. Eliminates Stock Pushers
7. Eliminates Feedout Cams

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

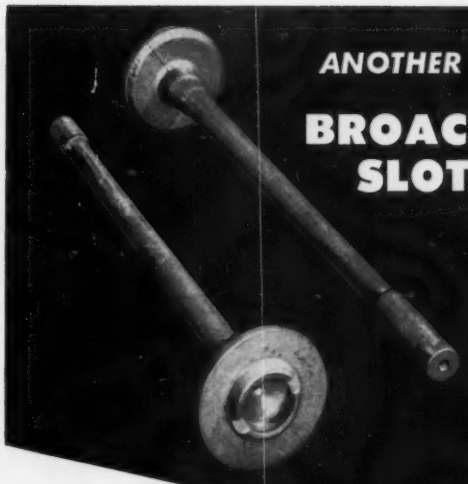
GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

1873 MASON AVE.
Rockford, Illinois

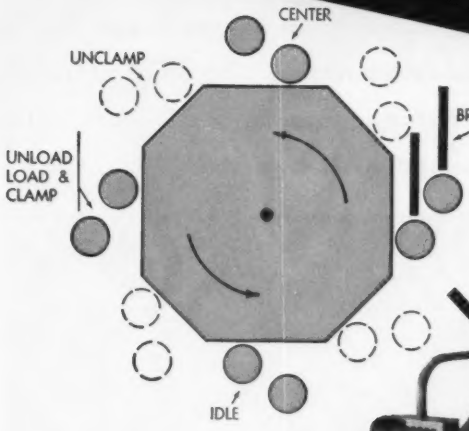


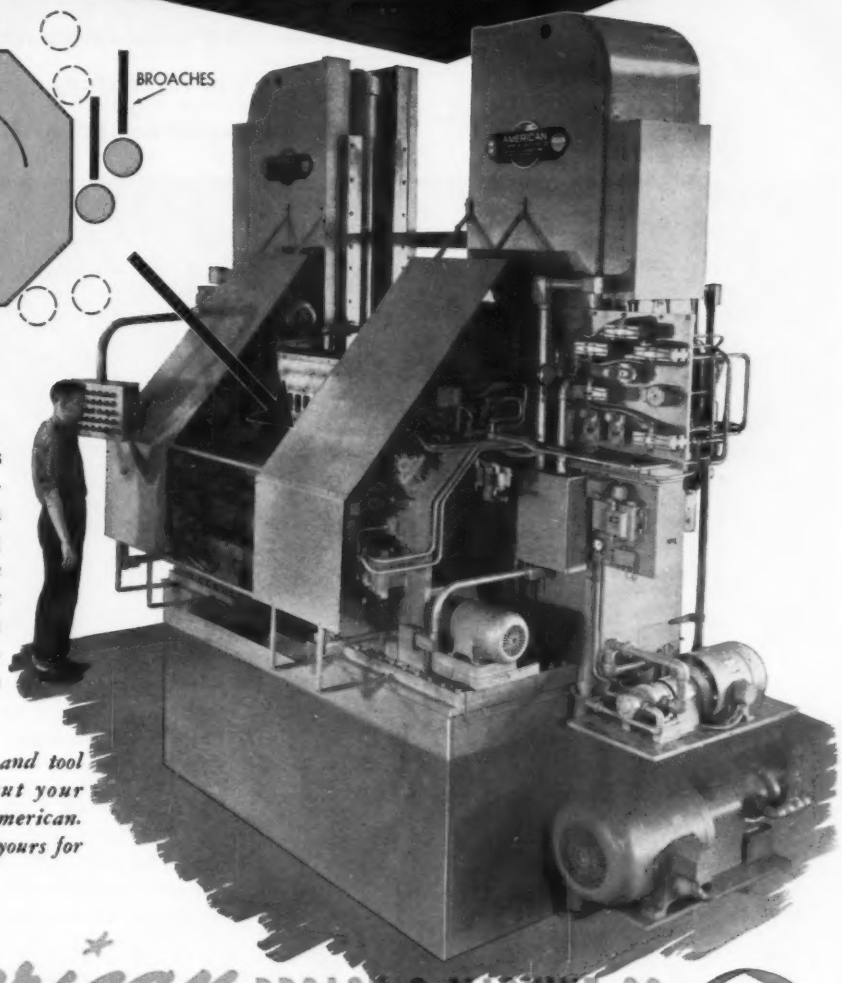
ANOTHER *American* FIRST

BROACH SHAFT ENDS
SLOT FLANGE ENDS
CENTER DRILL
BOTH ENDS

2 axle shafts every 30 seconds

Axle shafts of two different lengths are simultaneously broached at both ends and then center drilled on this American double column broaching machine. With a 30-second cycle, including 8 seconds for unloading and reloading by the operator, a production rate of 240 parts per hour is made possible.





A major tooling feature is an 8-position, drum-type indexing unit, equipped with four 2-station work holding fixtures. With the machine operating on the automatic cycle, operator reloads while broaching and center drilling is in progress at the other stations.

For the top-notch machine and tool engineering that will cut your broaching costs, contact American. American's Catalog 450 is yours for the asking.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

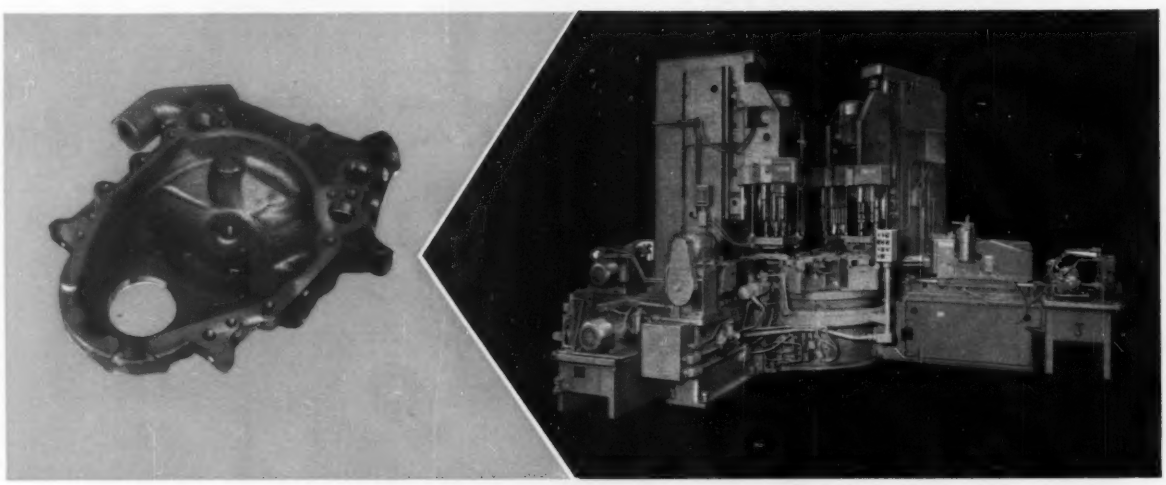
SUNDSTRAND

CONTROL cost-per-piece with **guaranteed production rates**

BarnesdriL engineers, through the use of special machining heads operating multiple cutting tools at high speeds, combine any number of machining operations into a single automatic cycle. This cycle is engineered to produce any desired number of pieces per hour in a sequence of operations, and makes it possible to establish minimum machining costs per piece. Consult a BarnesdriL field engineer for estimates on your multiple machining operations — either long or short run. Send us part prints with detailed operations for recommendations and estimates.

84 engine covers per hour . . .

37 operations: drilling, spotfacing, boring, reaming, tapping on BARNESDRIL **hydraulic unit machines.**



This 6-station rotary index production machine completes 37 machining operations on this engine-cover casting in a 34 second cycle. Average output at 80% efficiency is 84 covers per hour.

BarnesdriL standard hydraulic systems on these production machines are manifolded to eliminate hydraulic piping problems. All valves are flange-mounted for easy maintenance and fast replacement. Conforming to JIC standards, all components are mounted for easy access.

DETROIT OFFICE: 3419 South Telegraph Road, Dearborn, Michigan

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

there's a combination starter you KNOW is Safe!

Bulletin 712 Combination Starter consists of a standard Bulletin 709 across-the-line starter mounted in a cabinet with an A-B manual disconnect switch. Fuse clips are optional.

OPERATING LEVER CAN BE PADLOCKED IN "OFF" POSITION

You can use from one to three padlocks to lock this starter in the "off" position—or, for unusual applications, change it to permit padlocking in the "on" position.

TO OPEN COVER LEVER MUST BE IN "OFF" POSITION

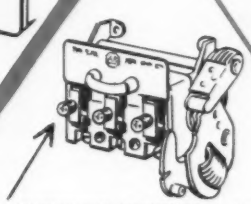
The disconnect switch lever is so interlocked that the cover of the cabinet cannot be opened until the disconnect switch is "open" and the starter is "dead."

COVER ITSELF CAN BE PADLOCKED

Provision for locking the cover to the base of the cabinet with a padlock eliminates all possibility of tampering with the mechanism.

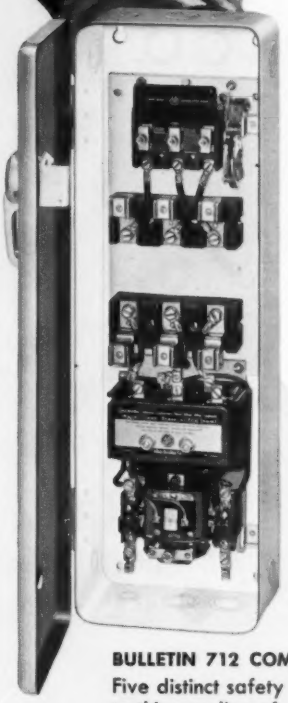
INSULATING SHIELD COVERS "LIVE" LINE TERMINALS

With the cover open, only the incoming line terminals are "alive"—and in Allen-Bradley Bulletin 712 starters, these are covered with an insulating shield.



MOVABLE CONTACTS ARE PLAINLY VISIBLE IN "OFF" POSITION

When in the "off" position, the movable disconnect switch contacts show above the arc hood in plain view. Welded or sticking contacts can be detected instantly—a reliable safety signal.



BULLETIN 712 COMBINATION STARTER

Five distinct safety features give "plus value" to this new line of Allen-Bradley Bulletin 712 Combination Starters. And—you also get the design simplicity and the many other advantages for which the Allen-Bradley solenoid starter has earned its "quality" reputation.

Available in NEMA Types 1, 4, 7, 9, and 12 enclosures, from 1 to 100 hp, 220v; 200 hp, 440-550v.

8-56-MR

A-B Quality

ALLEN-BRADLEY

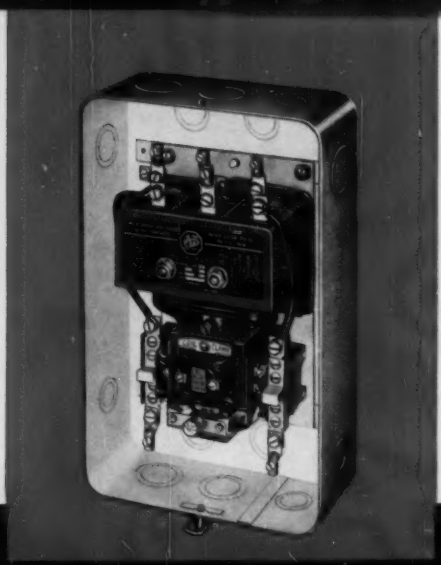
MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

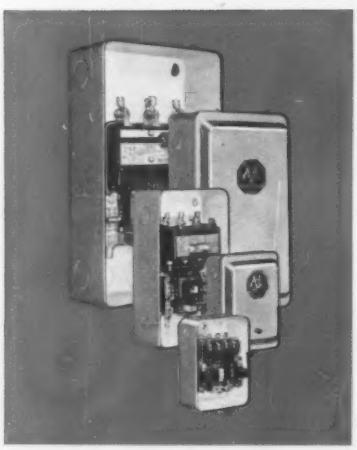
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

This simple design remains "tops"



Only one moving part–

that's why it's good for millions of operations!



Shown above are five sizes of the Bulletin 709 across-the-line solenoid starters. Three larger sizes are also available with a maximum rating of 300 hp, 220 volts; 600 hp, 440-550 volts.

The solenoid plunger shown above is the only moving part in any Allen-Bradley solenoid starter. Its straight up-and-down action is practically frictionless. There are no pivots, pins, or hinges to stick and cause trouble. That's why you are assured of millions of trouble free operations.

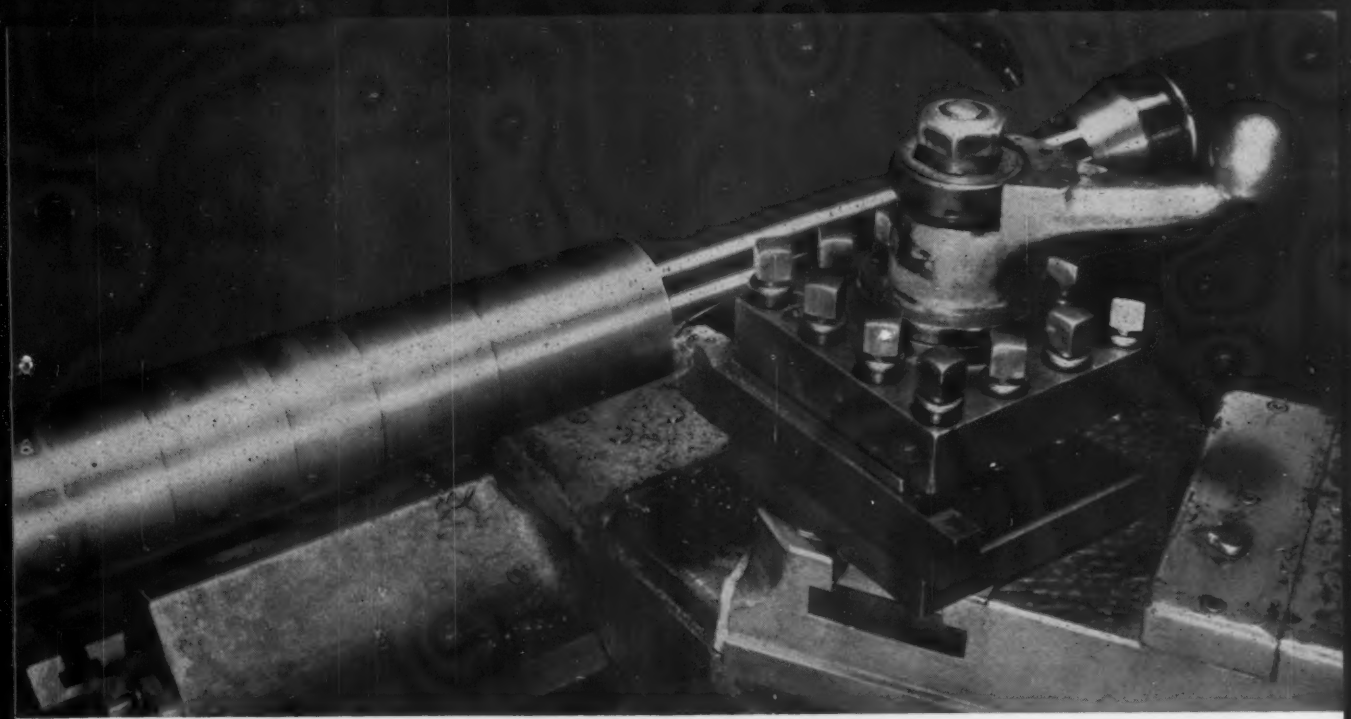
All Allen-Bradley solenoid starters have double break, silver alloy contacts that never need service attention of any kind. You just install them and forget them. On more and more automatic production machines, where continuity of operation is a "must," Allen-Bradley motor starters are standard equipment. Try them on your tough jobs!

A-B Quality

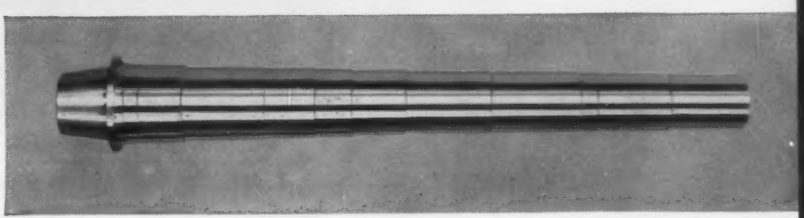
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

8-56-MR



Carboloy Cemented Oxide finishes 31-inch lathe spindles in 2.8 minutes at R. K. LeBlond Machine Tool Co. Carbide tool used previously required 6 minutes. With the Cemented Oxide tool, the 12-step cut is made at 715 fpm – more than double the speed with carbide. Work finish is improved, and machine output is increased 45% per grind.



Takes up where carbides leave off...

FINISH STEEL WITH CARBOLOY CEMENTED OXIDE; GET FINER FINISHES AT HIGHER MACHINE SPEED

With new Carboloy® Cemented Oxide, you can finish steel faster than ever before possible. Specially developed for machining at speeds beyond the range of carbides, Cemented Oxide produces superior surface finishes, while reducing your machining costs.

Cuts faster, wears longer

Field and laboratory tests show Carboloy Cemented Oxide can be used effectively at speeds from 300 to 7500 fpm, on steels up to 300 Brinell. It cuts cleanly, resists edge wear and cratering at surface speeds which would quickly ruin other cutting materials.

Carboloy Cemented Oxide brings you two major advantages: It lets you cut faster – and therefore more efficiently – with your present equipment; it reduces the time required to complete a job. And, its unusual wear-resistance at these high speeds means less downtime for tool changes, lower tool and grinding costs.

Resists chipping, stays cool

Cemented Oxide is an entirely new kind of cutting material. It is harder than carbide, stronger and more resistant to chipping than typical ceramics. Even at extremely high operating speeds, the tip stays so cool it can be touched immediately after the cut.

With Cemented Oxide Grade 0-30 and the three Carboloy extra-performance carbide grades, you now have a specialized cutting material available for every steel-cutting job from roughing to super high-speed finishing. Limited quantities of Cemented Oxide Grade 0-30 are ready for evaluation on your finishing jobs. For information or technical bulletin, send the coupon on page 4 of this advertisement.

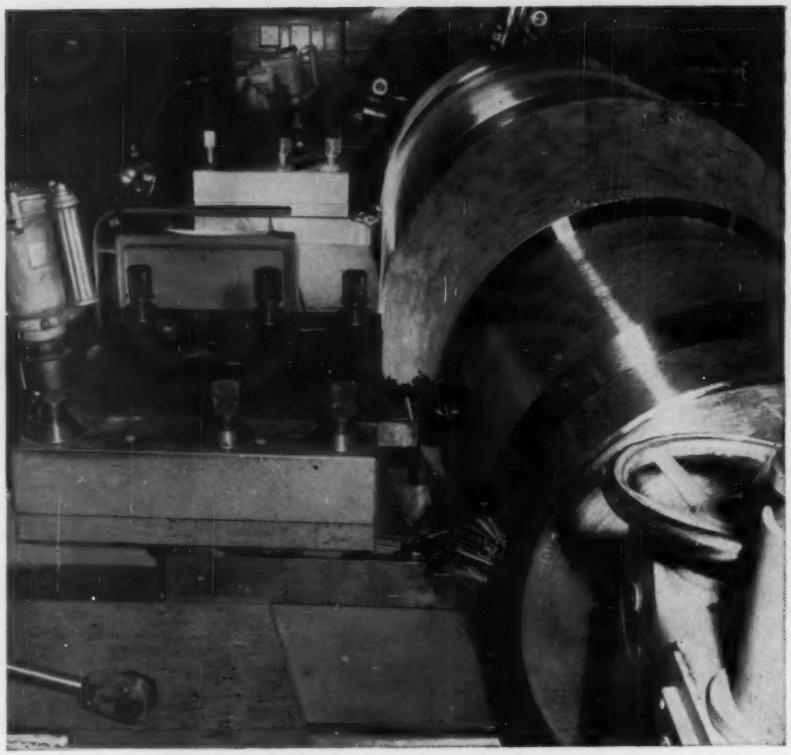
CARBOLOY
CEMENTED OXIDE

GRADE 370

EXTRA-PERFORMANCE CARBIDE FOR HEAVY-DUTY ROUGHING

Grade 370 is built to take heavier roughing cuts at higher speeds and feeds . . . yet outlast conventional carbides. Hundreds of in-plant tests have proved Grade 370 will remove more metal per minute – and take more regrinds – than any other grade.

For example, on huge steel backup rolls like the 31-ton roll at right, a single Grade 370 insert has removed 24,000 cubic inches in 2½ hours . . . without regrinding. Cutting through rough scale and hard seams, Carboloy Grade 370 tools will finish this job in 16½ hours.



For every job from roughing to finishing . . .

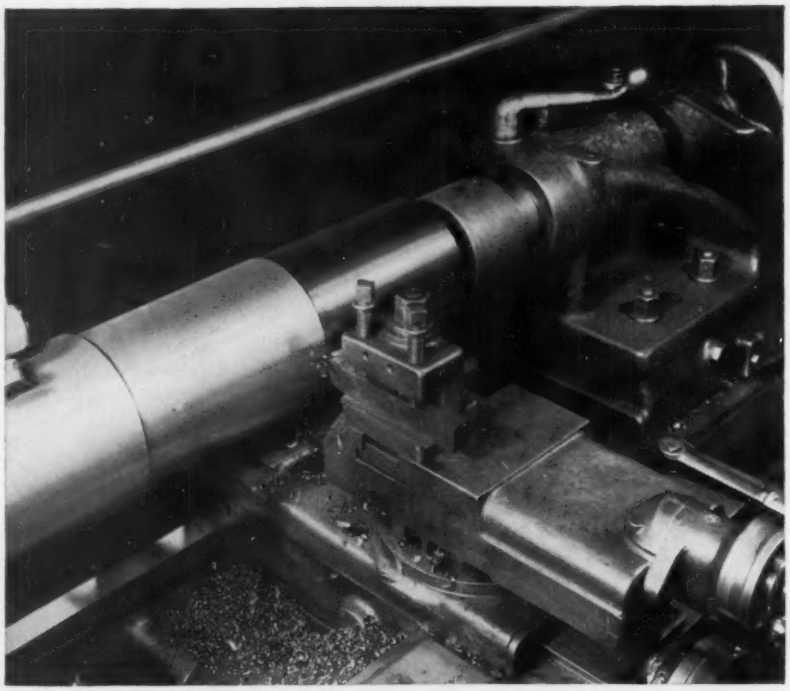
CUT STEEL FASTER, LOWER TOOL COSTS WITH

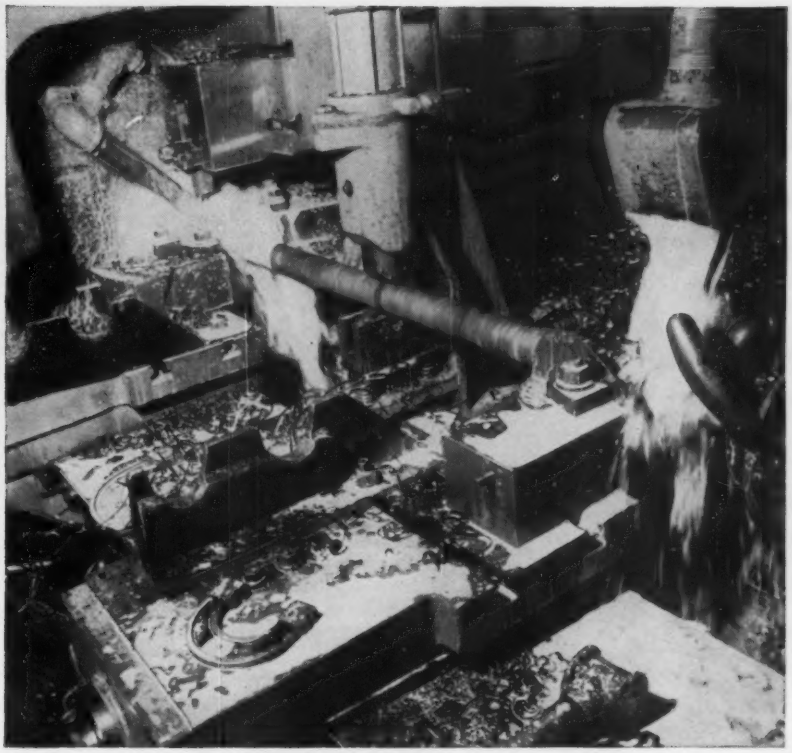
GRADE 330

EXTRA-PERFORMANCE CARBIDE FOR FINISHING AND BORING

New Carboloy Grade 330 is twice as strong as conventional steel-finishing grades. Its entirely new composition makes 330 easier to braze, yet more resistant to chipping. Unlike other finishing grades, Grade 330 is so tough it can be ground on automatic grinders without cracking.

Grade 330 can take speeds 10% higher than other carbides, without loss of tool life. When compared at a series of speeds ranging from 600 to 1900 fpm, Grade 330 outlasted other grades by 20%-35%. (Picture at right shows surface finish obtained on S.A.E. 1045 steel at 800 FPM.)





GRADE 350

EXTRA-PERFORMANCE CARBIDE FOR MEDIUM-DUTY MACHINING

Grade 350 was specially developed to increase your machines' efficiency in the light roughing and general finishing range. Built-in structural rigidity enables Grade 350 to withstand steel-cutting conditions which quickly cause tip deformation in ordinary carbides. Its extra strength gives you more production per grind, more grinds per tool.

For example, in machining the AISI 4150 truck axle forging at right, Grade 350 boosted production 33%. In addition, Grade 350 eliminated chipping and flaking encountered with other carbides.

CARBOLOY EXTRA-PERFORMANCE CARBIDES

- **Take heavier, deeper cuts with Grades 330, 350, 370**
- **Get increased production from machines and manpower**

Announcement of new Grade 330 means you now have a choice of *three* Carboloy extra-performance steel-cutting carbides.

New Grade 330 takes up on finishing and boring jobs where medium-duty Grade 350 leaves off. And together with heavy-duty Grade 370, these carbides offer you faster cutting at lower cost over the complete steel-cutting range from roughing to finishing.

Outperform conventional carbides

Service-proved on thousands of applications like the ones above, these grades consistently outperform conventional carbides. Even at higher speeds and feeds, they take heavier, deeper cuts . . . yet outwear other grades.

Their superior strength means more production per hour, greater output per machine. Their resistance to wear means less downtime, fewer wasted man-hours for tool changes, and lower tool costs.

Complete line stocked locally

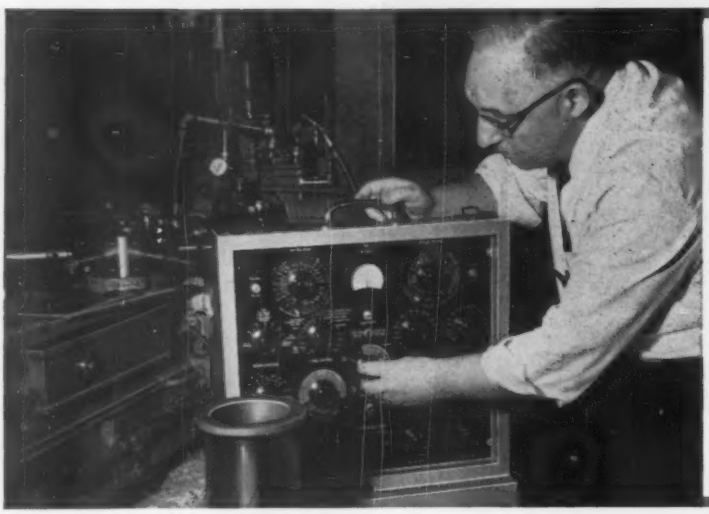
All three of these extra-performance carbides are stocked locally by your Authorized Carboloy Distributor. They are available in a complete line of standard tools and blanks, as well as inserts for your toolholders.

Try these extra-performance carbides in your plant . . . and see why there is no such thing as an "equivalent grade" for Carboloy 330, 350, and 370. For more information, see your Carboloy Distributor, or mail the coupon on page 4 of this advertisement.

CARBOLOY
CEMENTED CARBIDES

CUT MACHINING COSTS, SAVE SETUP TIME WITH CARBOLOY MACHINABILITY COMPUTER

- ▶ **Determine most efficient cutting conditions in seconds**
- ▶ **Eliminate wasteful tryout runs, save valuable stock**
- ▶ **Get closer control over inventories and production schedules**



How the Machinability Computer is helping Scully-Jones and Co.

Original operating standard for machining expanding shells called for 244 minutes per part. But by calculating the optimum combination of speeds, feeds, and other data on the Computer, the company saved 77.8 minutes per part. Machining time was cut 32% . . . 17 machining hours were saved on a 13-piece run. Scully-Jones used the Computer to determine correct setups for both HSS and carbide tools—on turning, facing, drilling, and boring jobs.

Scully-Jones and Co., Chicago, is just one of hundreds of plants now getting greater production from their machines by using the Carboloy Machinability Computer.

Machining data are fed into the Computer . . . and in seconds, optimum speeds, feeds, horsepower ratings, or any of 16 other operating variables are accurately figured for the machinist.

On the job above, for example, the Computer showed how to cut machining time 32% on a 13-piece run . . . saving 17 machining hours and eliminating wasteful tryout runs.

Benefits extend plant-wide

On other jobs throughout the plant, the Computer establishes new operating standards, corrects and verifies existing ones . . . in a fraction of the time previously required.

In addition, the Computer simplifies inventory problems by predicting rate of tool wear. It aids grinding rooms plan work loads; helps management coordinate production schedules. The Computer is a versatile engineering tool for any sized plant.

Ask for demonstration

Price of the Carboloy Machinability Computer is $495, f.o.b. factory, Detroit. It is battery-operated, portable, and rugged; can be used by anyone with machining experience after a short familiarization period.

For more information on how the Computer can help your plant increase production and reduce manpower costs, mail the coupon below. If you wish, we will gladly arrange a demonstration in your plant.

CARBOLOY

MACHINABILITY COMPUTER

Metallurgical Products Department
General Electric Company
11147 E. 8 Mile Ave., Detroit 32, Mich.

Send me information on the following products:

- ☐ Carboloy Cemented Oxide Grade 0-30
- ☐ Steel-Cutting Grades 330, 350, and 370
- ☐ Carboloy Machinability Computer
- ☐ Have a representative make an appointment to demonstrate the Computer

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Carboloy is a trademark of General Electric Company

AT THE METAL SHOW: **"New Worlds in Metalcutting" with Carboloy Cemented Oxide and Carboloy carbide grades 330, 350, and 370. *Booth No. 2124.***

still the winner

...and in high speed steels, nothing beats REX

The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

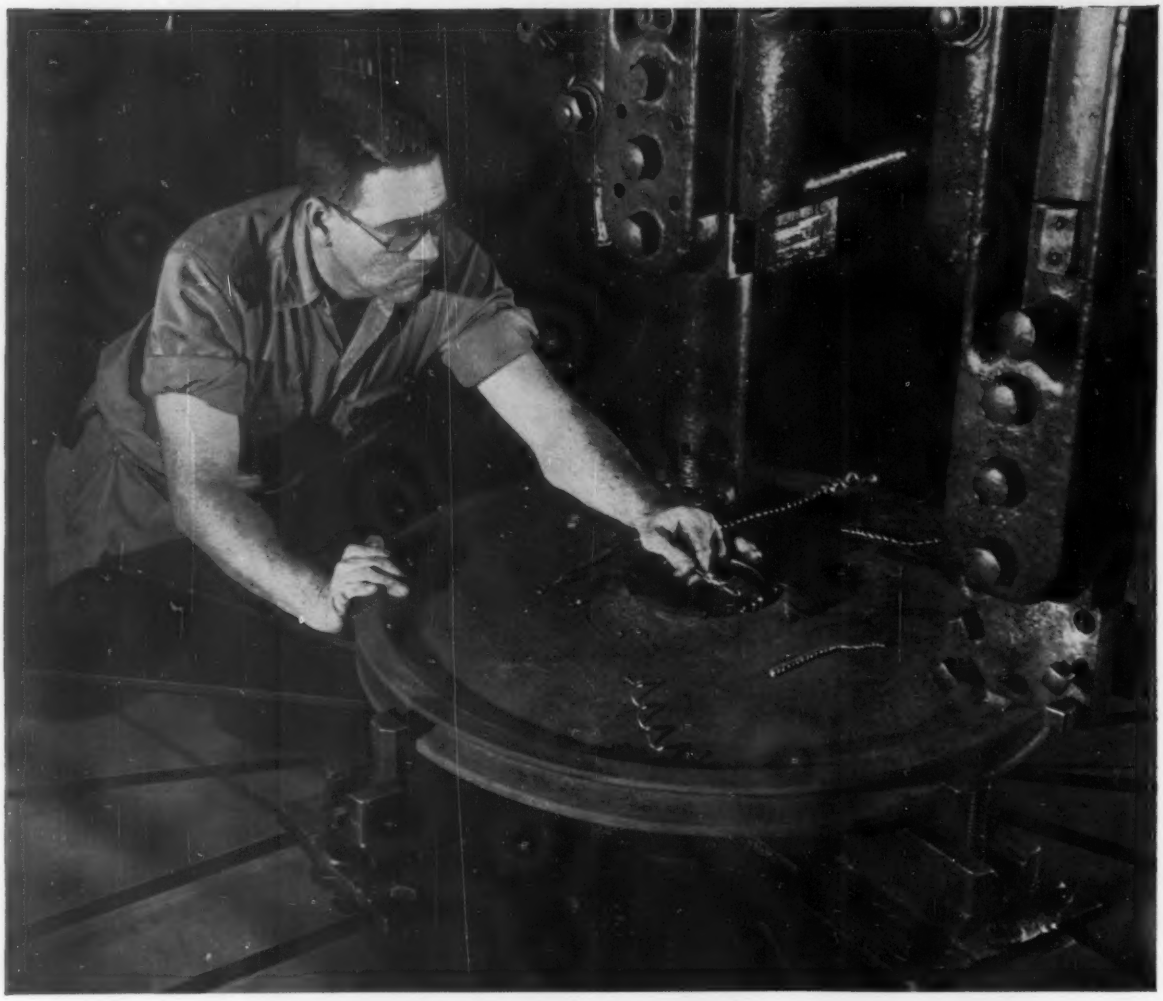
Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 263



He's shooting for perfection

This earnest young man is intent on turning out a perfect sheave. From the looks of the job, we'd say his chances are fine. Best-looking sheave wheel we've seen in quite a while.

He has done his machining with great care, and with complete confidence. That confidence is warranted, for the wheel was first a Bethlehem steel blank, made by Bethlehem's forging-and-rolling process.

If you've never seen this method of manufacture, let us explain it briefly. It employs a mill that is the only one of its kind in the entire country. Blanks are not just forged, not just rolled, but *both*—in a single operation that produces high strength and very desirable grain flow.

That high strength is important. Equally important is the way the blanks machine. In the customer's shop, machinists can do their job with assurance, knowing that the metal underneath is as firm and "sweet" as that on top.

Bethlehem forged-and-rolled blanks are available for a long list of applications, including spur, bevel, miter, and other types of gears; crane and sheave wheels; turbine rotors, clutch drums, brake drums, flywheels, pipe flanges, and numerous others. You can obtain the blanks in sizes from 10 to 42 in. OD, untreated or heat-treated. For full details, ask for Booklet 216; it will be sent to you promptly.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

NEW OAKITE CLEANERS
GIVE YOU MORE FOR YOUR
PAINT-PREPARATION DOLLAR

Here are 6 ways to end pre-paint metal-cleaning troubles

Does your trouble chart show that you need better cleaners, strippers or surface conditioners?

- ☐ Cleaning solution foams excessively in spray washing machine. See 1 below.
- ☐ Streaky discolorations or powdery residues cling to surface of steel parts being stripped for repainting. See 2.
- ☐ Aluminum parts are severely etched while being stripped of zinc chromate primer or other finishes. See 3.
- ☐ Zinc phosphating process too difficult to control—requires too many titrations, too many additions, etc. See 4.
- ☐ Iron phosphating process doesn't show good results in salt spray tests. See 5.
- ☐ Too many operations—cleaning, pickling, neutralizing, etc.—are needed to prepare steel that does not require phosphating before painting. See 6.

Here are brief descriptions of new Oakite materials designed to end these particular troubles:

1. For a spray washing solution that does not foam at high pressure, try Oakite Composition No. 161. Does not attack aluminum.
2. For stripping pigmented paint, phosphate coatings and undercoat rust *in one operation*, try Oakite Rustripper.
3. For safe, thorough stripping of aluminum, try Oakite Stripper No. 110.
4. For a zinc phosphating process that is truly easy to control, try new Oakite CrysCoat SW. No accelerators, starters or toners. Only one material used for make-up and up-keep.
5. For salt spray results far beyond the capacity of ordinary phosphating processes, try new Oakite CrysCoat No. 89.
6. For *one-operation* removal of rust, heat scale, welding residues and light soil together with good preparation for painting, try Oakite Compound No. 131. Inhibited against attack on steel.

FREE Check the coupon and we will send you free booklets or bulletins containing complete information on the new Oakite materials in which you are interested.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

Expert Division Cable Address: Oakite

OAKITE PRODUCTS, INC.
26 Rector Street, New York 6, N.Y.

Send me free booklets or bulletins giving complete information on the new Oakite materials checked below:

- ☐ Oakite Composition No. 161
- ☐ Oakite Rustripper
- ☐ Oakite Stripper No. 110
- ☐ Oakite CrysCoat SW
- ☐ Oakite CrysCoat No. 89
- ☐ Oakite Compound No. 131

Name _____

Company _____

Address _____

For more information fill in page number on Inquiry Card, on page 263

Chipping and Edge Breakdown Eliminated by Switching to **STELLITE** *Alloy Tools*

HAYNES STELLITE Star J-Metal tools mill an average of 220 of these cast iron differential housings per grind despite periodic contact with hard white iron spots. Chipping and edge breakdown, major problems when other tool materials were used, have been eliminated by switching to STELLITE alloy tools. As a result, unscheduled down time has been drastically cut. About 3/16 in. of stock is removed from each casting with 0.010 to 0.012 in. chip load per tooth. Cutting speed is 88 surface ft. per minute. The 40 standard Ingersoll-type blades mounted in a 12-in. cutter can be counted on for a full shift's production.

HAYNES STELLITE alloy tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. They resist chipping and spalling in spite of severe shock. Metal removal is fast because high speeds, comparatively high feed rates, and deep cuts can be used.

For more information on efficient metal removal with HAYNES STELLITE tools, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools." It gives information on chip formation, tool design, and grinding procedures.

"Haynes", "Haynes Stellite", and "Stellite" are registered trademarks of Union Carbide and Carbon Corporation.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

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AVOID the
HIGH COST
and difficulty
of fabricating
long, hard
& straight parts
by conventional
methods . . .

THOMSON

60 Case

hardened and ground

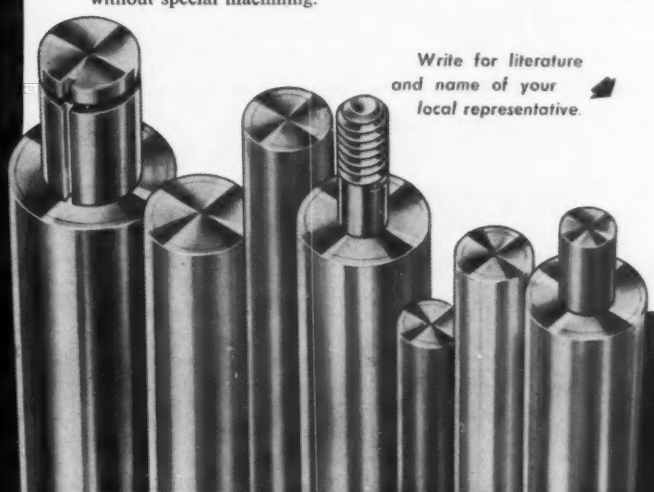
SHAFTS, ROLLS, GUIDE RODS and other long-round parts

60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.



Write for literature and name of your local representative.

ADVANTAGES of *60 Case*

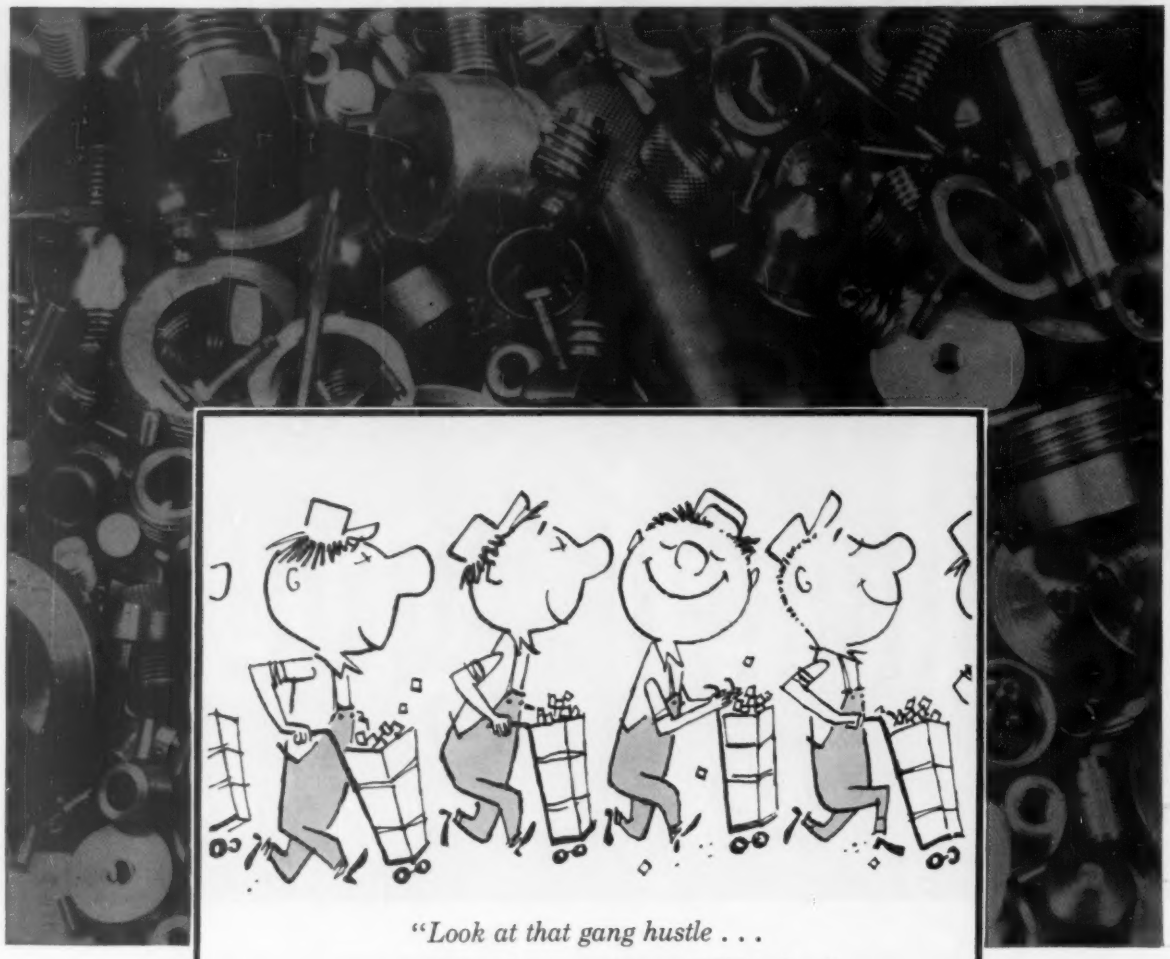
- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C6, Manhasset, New York

For more information fill in page number on Inquiry Card, on page 263



"Look at that gang hustle . . .
you can tell we're running on MX today."

You can confidently count on bigger output—more parts per hour—when you put USS Free-machining MX Steel to work.

By making it possible to run at cutting speeds up to 50% higher than normally used with regular Bessemer grades, MX has boosted production in hundreds of shops from 10 to 50%—an average of 40%. And with this easier machining steel, tools have lasted up to 200% longer.

USS Free-machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today . . . yet it costs no more than ordinary screw stock.

Based on the results obtained in producing more than a billion parts of many different kinds and under different conditions, we feel sure that MX will cut the cost of any part you now machine from ordinary screw stock. It does this in four ways.

By increasing the rate of production, *MX lowers the cost per part.* By prolonging tool life, *MX reduces down time.* By assuring better part finish, *MX often eliminates extra finishing operations.* By providing closer dimensional accuracy, *MX helps to minimize rejects.*

Available in both Bessemer and Open-Hearth grades, USS Free-machining MX is produced in all the popular screw stock sizes. It is sold in cold finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our district sales offices.

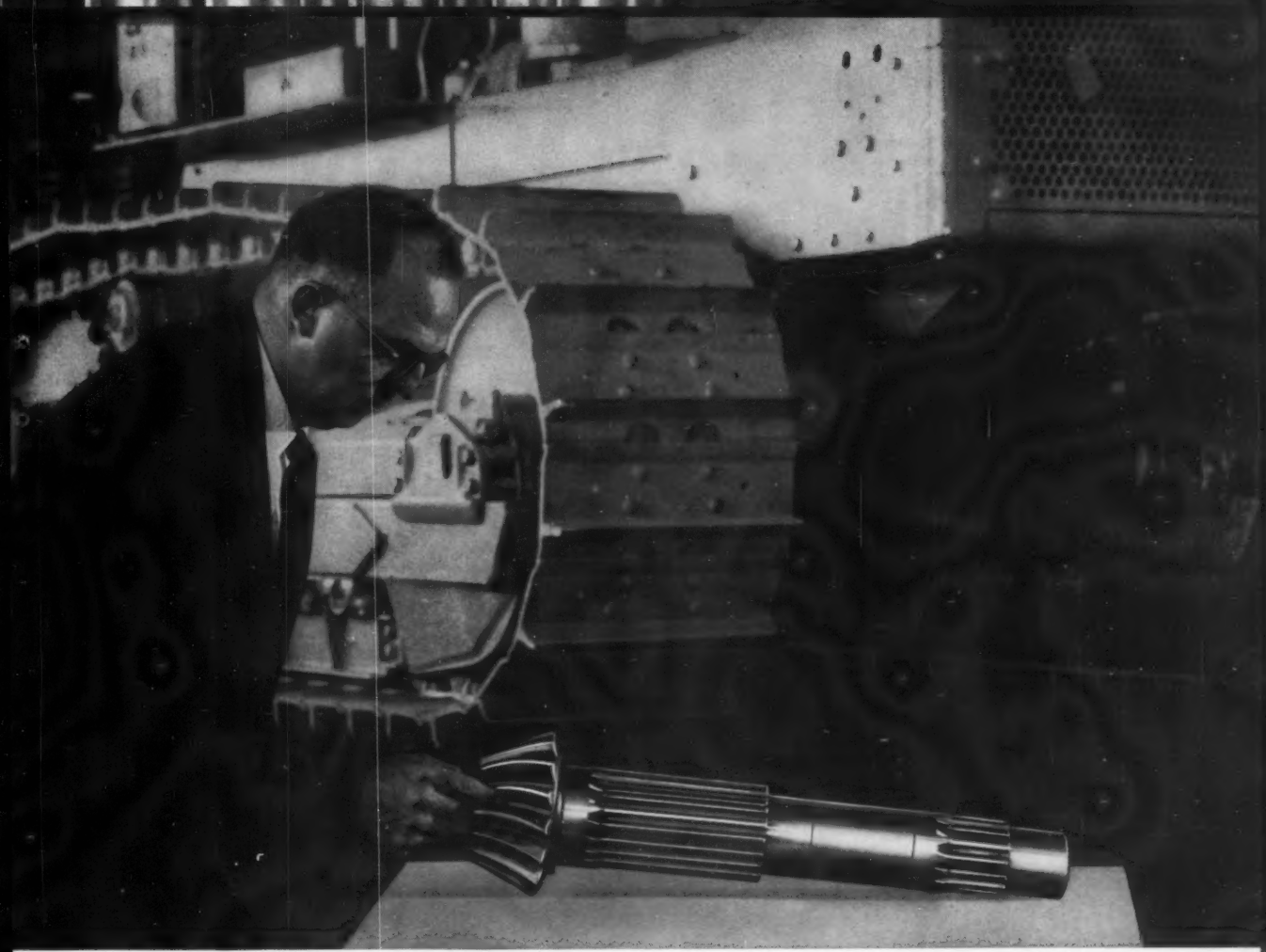
UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs

—when you do the job with free-machining MX

USS

UNITED STATES STEEL



Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

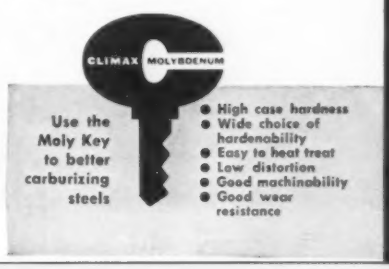
Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 13, 500 Fifth Avenue, New York 36, N. Y.

CLIMAX MOLYBDENUM



...the shapers of things to come —

ALLEGHENY LUDLUM HIGH SPEED STEEL TOOL BITS

In a complete range of tungsten, moly, cobalt, and high vanadium types

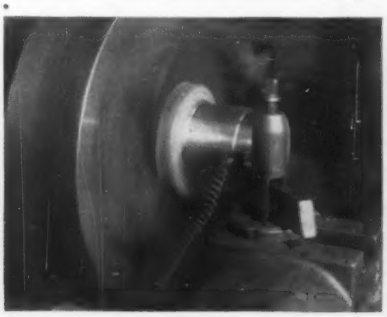
PANTHER 5
SUPER PANTHER
PANTHER SPECIAL
ML, LXX, SUPER DBL
DBL-3 AND DBL-2

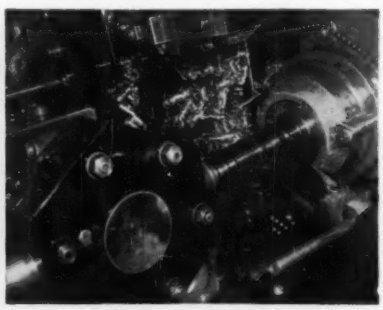
Cut to length . . . bevelled both ends . . . heat-treated to perfection. Just shape the point and you're all ready to go . . . A-L Tool Bits are the last word in convenience.

Made in a complete range of tungsten and moly high speed steels . . . including the new cobalt and high vanadium types that offer superior red hardness, wear-resisting and cutting properties.

Furnished in Standard finish or the popular Ground finish which is extremely accurate in dimension and free from decarburization and scale.

For real Johnny-on-the-spot service on the finest tool bits obtainable, call your local A-L office or distributor . . . TODAY! • *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*





For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854

WSW 6278

For more information fill in page number on Inquiry Card, on page 263

Tool Steel Topics

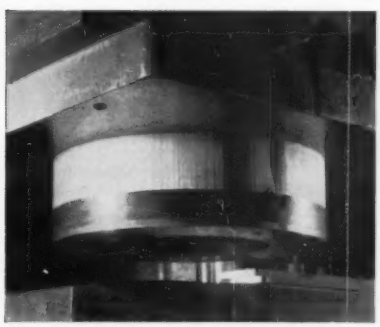
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Good Results with BTR Hollow-Bar in Manufacture of Fan Housing

Based upon all-around performance — less time spent in machining, good resistance to wear, and ease of heat-treatment — dies of BTR (Bethlehem Tool Room) Hollow-Bar rang the bell recently at Electrolux Corp., Old Greenwich, Conn.; the steel was supplied by Lindquist Steels, Inc., Bridgeport, Conn.

The dies, hardened to approximately Rockwell C 60, and operating in a 100-ton press, formed fan housings from 25-gage zinc-coated sheet steel at the rate of more than 1600 pieces per hour. Redressing was required once every two months or so, and then no more than 0.010 in. was removed.



BTR Hollow-Bar is made from our oil-hardening tool steel by a process called high-speed trepanning. By this method, we take hammer-forged round bars, core the inside diameter, then give them a rough-turning on the outside.

With BTR Hollow-Bar there's no need to run up shop costs waiting for delivery of forged rings or discs. Instead, this fine tool steel comes to you ready to go, with no need for drilling, rough-boring, rough-facing or rough-turning.

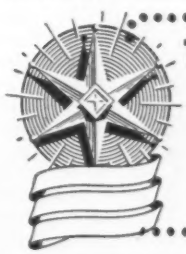
Your Bethlehem tool-steel distributor will be glad to explain how BTR Hollow-Bar can be of real service to you. Or a phone call or letter to the nearest Bethlehem sales office will bring you detailed information promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Remove all the "Bark" from Liquid-Quenched Tools

Most users of tool steel realize that it is necessary to remove the "bark" (scaled and decarburized outer surface) from tool-steel bars in order to obtain full, uniform hardness in heat-treatment. If this area is not removed, low hardness will result because of the low carbon content of the decarburized metal. It is not always recognized that this procedure is necessary on tools which are to be liquid quenched, even though portions of the tool do not constitute working surfaces.

If tools are to be liquid quenched, all the bark must be removed to avoid excessively high quenching stresses which could cause cracking of tools during hardening. Low carbon areas on the surface transform during hardening at a different time than the higher carbon interior. This sets up additional stress which, added to the high thermal stresses from quenching, could cause cracking. Air-hardened tools can tolerate bark on non-working areas because of the low hardening stresses in air hardening. But with liquid-quenched tools there are no exceptions — remove all the bark.



TOOL STEEL MOVIE WINS ANOTHER AWARD

"Teamwork," Bethlehem's new motion picture on tool steel, received a second film award, a silver reel symbolic of excellence, at the recent American Film Assembly competition in Chicago.

The 16-mm, 30-minute color film explains the manufacture, quality control and heat-treatment of Bethlehem tool steels. It is available for showings to machinists, heat-treaters, die makers and tool manufacturers. To see the film, write to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

For more information fill in page number on Inquiry Card, on page 263

New GRAPH-AIR®...

the air-hardening graphitic tool steel for intricate parts that must take abuse!

HERE'S how manufacturers of gages, dies and other steel products requiring stable and machinable and tough steel can find new savings, better performance. The Timken Company announces the latest addition to its line of graphitic tool steels—Graph-Air®. This new tool steel has all the properties of famous Graph-Mo® and it's *air-hardening*. Graph-Air is ideal for such demanding applications as blanking dies and other parts that must stand up to hard abuse. Being an air-hardening steel, there's less distortion in heat treating than with oil-hardening steel—less decarburizing than with other air-hardening steels. And Graph-Air is easier to control in heat treating because it air-hardens at lower temperatures than ordinary air-hardening steels.

Graph-Air not only eliminates the need for oil quenching facilities, and other relatively costly heat-treating processes—it air-hardens at temperatures of 1450°F to 1525°F. This is 200° to 300° lower than most other air-hardening tool steels. Like famous Graph-Mo, Graph-Air *outwears ordinary tool steels* because of the uniform diamond-hard carbides in its structure.

It *machines 30% faster* because free graphite in its structure acts as a built-in lubricant. Graph-Air has the same high stability as other Timken graphitic tool steels, which are the most stable tool steels made!

A result of the Timken Company's pioneering in fine alloy steels, Graph-Air will be available in both solid and hollow-bar sizes. For details, write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

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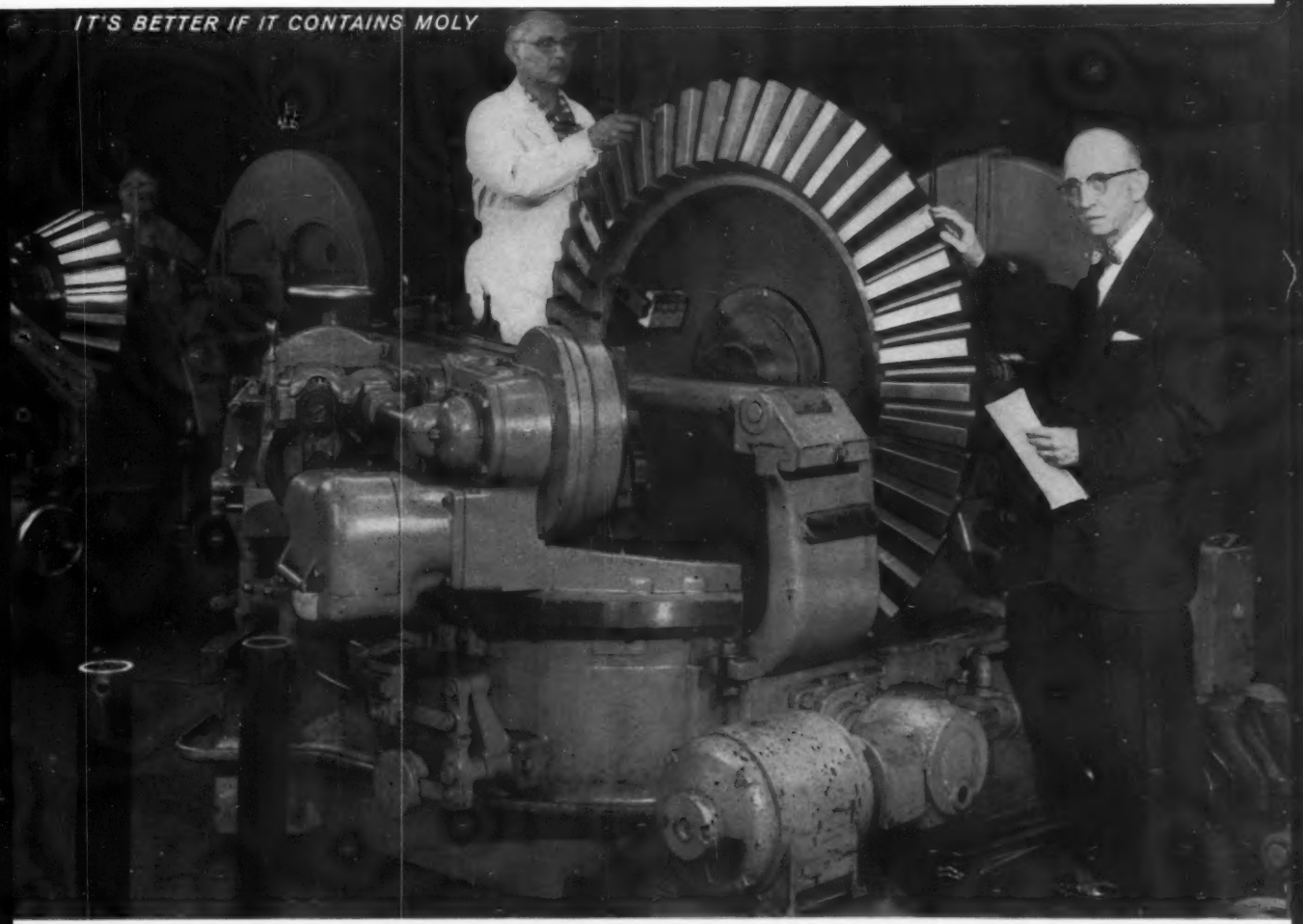
IT'S BETTER IF IT CONTAINS MOLY



E. B. Smiley, Metallurgist for Illinois Gear & Machine Co., looks over setup of large, heavy duty bevel gear made from molybdenum alloy steel casting. This gear has been rough turned, rough cut and heat treated to 269 to 302 Brinell before finish cutting.

For Strength, Hardness and Machinability gear maker recommends Molybdenum Alloy Steels

"All of our gears are made to customer specifications, and in many cases these include the use of molybdenum steels," says Mr. Smiley, metallurgist for Illinois Gear & Machine Co. "When our customers specify heat-treated gears of plain carbon steel," Mr. Smiley continues, "we often recommend that they change to 4140 alloy containing molybdenum to achieve high strength and hardenability with good machinability."

Moly steels offer gear users many advantages over carbon steel. Their greater strength and toughness permit the use of smaller weight-saving gears to transmit a given amount of power. Reduced weight and size of gear housings and other components add to the economy of moly steels. And their higher endurance is an important safety factor.

The properties of moly steels are discussed in a new booklet "Moly Steels for Cast Gears". Full technical assistance is also yours for the asking. Write Climax Molybdenum Co., Dept. 13, New York 36, N. Y.

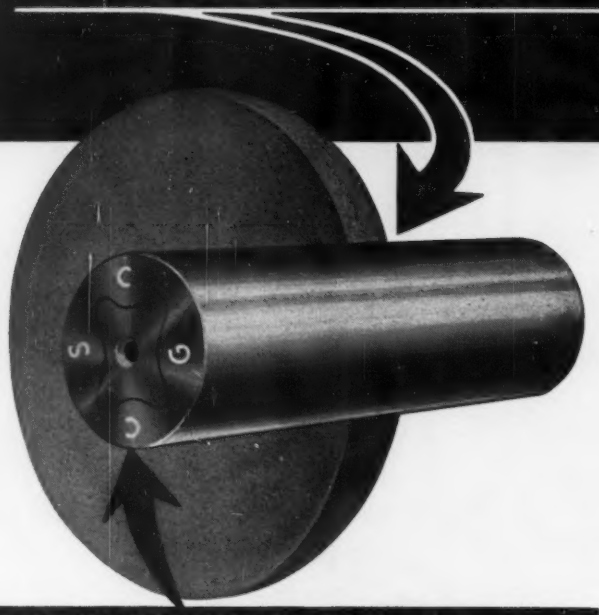
CLIMAX MOLYBDENUM

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

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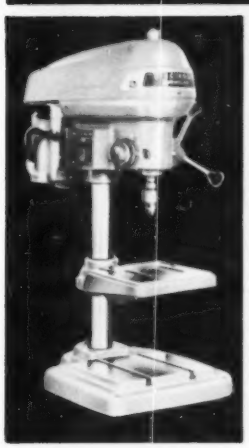


BUSINESS MACHINE MANUFACTURERS have calculated the risk of obsolete machine tools and started dynamic replacement programs. They know that over half the 9,000 drilling machines and 9,000 lathes were built to World War II standards.* In fact, over half the machine tools in America are over a decade old. The penalty of this is easy to see in the lower prices of your alert competitors and in our country's position in freedom's fight.

Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

PRINTED IN U.S.A.

center on... **cincinnati lathes and drills**

Machines shown are Cincinnati's new 16" Royal Drill and 15" Tray-Top Lathe.

Got a Production Problem?

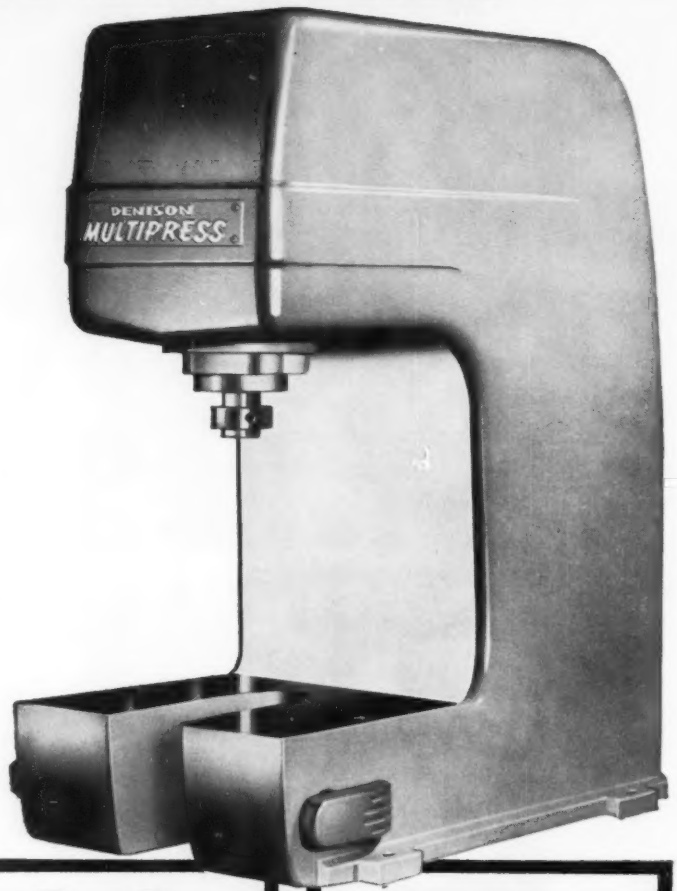
...THAT NEEDS A PRESS NOW

Immediately Available

High-speed production tool

Here's a NEW 1-ton hydraulic

MULTIPRESS®



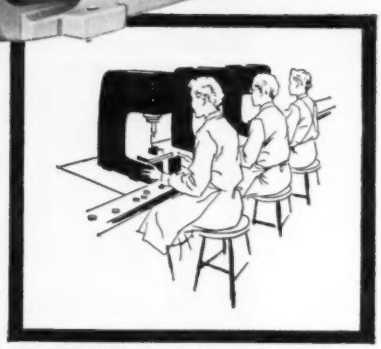
- Gives up to 150 ram strokes per minute.
- Ram pressures adjustable up to 1-ton.
- Automatic pressure reversal.
- Completely self contained.
- Your present tooling easily adaptable.
- Dual manual safety control.

Only $395.00

F.O.B. Factory. Subject to prior sale

CUTS YOUR TOOLING COSTS ON SMALL AND LARGE QUANTITY LOTS—Many shop operations can be simplified because you can move Multipress quickly and easily from department to department, wherever a press is needed. And, because Multipress can be moved around, it can be stored in your tool crib complete with tooling setup until the particular production job is run again.

SIMPLIFIES AUTOMATIC OPERATIONS—Multipress is specially engineered for automation. It can be mounted simply around dial tables and indexing fixtures to keep your tooling costs to an absolute minimum. The Multipress controls can be actuated electrically, pneumatically or hydraulically from external sources making it easy to interlock the Multipress in with other automatic production operations.



IDEAL FOR CONTINUOUS LINE PRODUCTION—Two or more Multipress units can be easily set up side by side to handle straight line production work. Surprisingly small bench area is needed for line production work because of the compact, operator-engineered design developed in the 1-ton Multipress.

WRITE NOW

DENISON ENGINEERING DIVISION

American Brake Shoe Co.

1244 Dublin Road Columbus 16, Ohio

DENISON HydrOILics

For more information fill in page number on Inquiry Card, on page 263

John Topman, Factory Superintendent, says:

"I LIKE GEOMETRICS because . . .

. . . I'm interested in production schedules, costs and quality control. GEOMETRIC tools suit me on all counts, they're dependable, economical and, of course, you can't beat them for accuracy. Just look at the workmanship in this collapsing tap!

Their distributors and their own service engineers give us wonderful co-operation, too. Yes, I'm sold on GEOMETRIC Die Heads and Collapsing Taps."

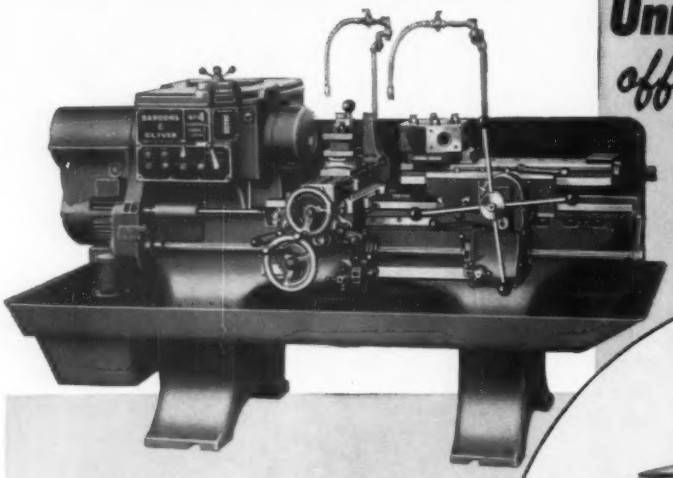
Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

New Haven 15, Connecticut

GEO MET RIC

The BARDONS & OLIVER No. 4 Universal Turret Lathe offers these outstanding HEADSTOCK Features



- Sixteen geared spindle speeds, providing a fifty to one speed range
- Optional spindle speed ranges with maximum up to 2000 R.P.M.
- Constant horsepower (optional to fifteen) at all spindle speeds
- Fast operating and effortless electric headstock clutches
- Fully automatic spindle speed changing in less than two seconds
- Minimum number of gears in mesh at higher spindle speeds
- All anti-friction bearings
- Flanged type motor mounting
- All headstock gears of alloy steel, flame hardened and precision finished
- Headstock shafts of alloy steel, heat treated, ground-in-spline, of large diameter and short span between bearings
- All rotating assemblies statically and dynamically balanced
- Cool, filtered lubricating oil pumped to all headstock bearings, gears and clutches from separate reservoir in the head-end leg

The complete line of Bardons & Oliver Turret Lathes offers many outstanding features. Write us on your company letterhead for specific model information or send your blue prints for a proposal.

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING-OFF LATHES

BARDONS & OLIVER, INC.

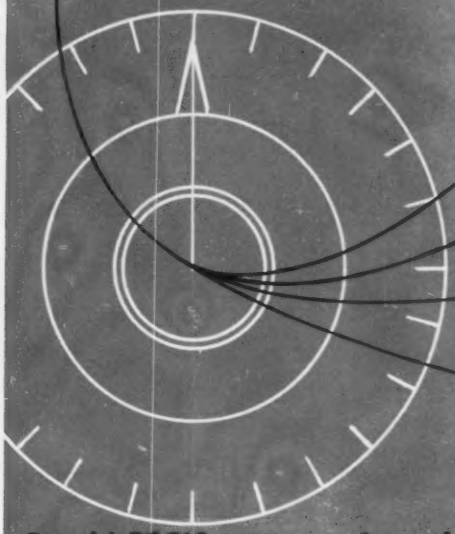
1135 WEST 9TH STREET • CLEVELAND 13, OHIO

RIGHT R AND LEFT L TOOLS

your combination . . .

TO LOWER COSTS . . . GREATER PROFITS!

In this day and age of AUTOMATION set-up time is a prime cost factor. Cut your set-up time by as much as 75% with R and L TOOLS.

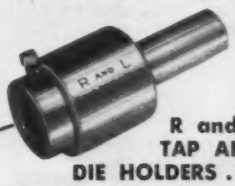


R and L TURNING TOOL . . .

changes in 10 seconds for right or left turning, and replaces an assortment of 14 tools costing more than five times that of one R and L Turning Tool.

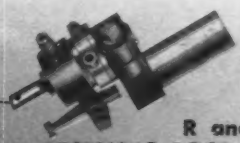
R and L KNURLING TOOL . . .

Half the weight . . . twice as efficient as other knurling tools. One hex wrench makes all adjustments.



R and L TAP AND DIE HOLDERS . . .

New release mechanism makes right or left threading possible . . . an exclusive R and L feature.



R and L RECESSING TOOL . . .

Can be adjusted to operate on any internal diameter within capacity of machine . . . Newly designed!

R and L TOOLS are masterpieces of the toolmaker's art . . . guaranteed not to bend or give way. Thousands of users attest that they pay for themselves in no time!

Write for New Catalog

R and L TOOLS
1825 BRISTOL ST.
PHILADELPHIA 40, PA.

☐ Please send me your new catalog

☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....

COMPANY .....

ADDRESS .....

M-10

RIGHT R and LEFT L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

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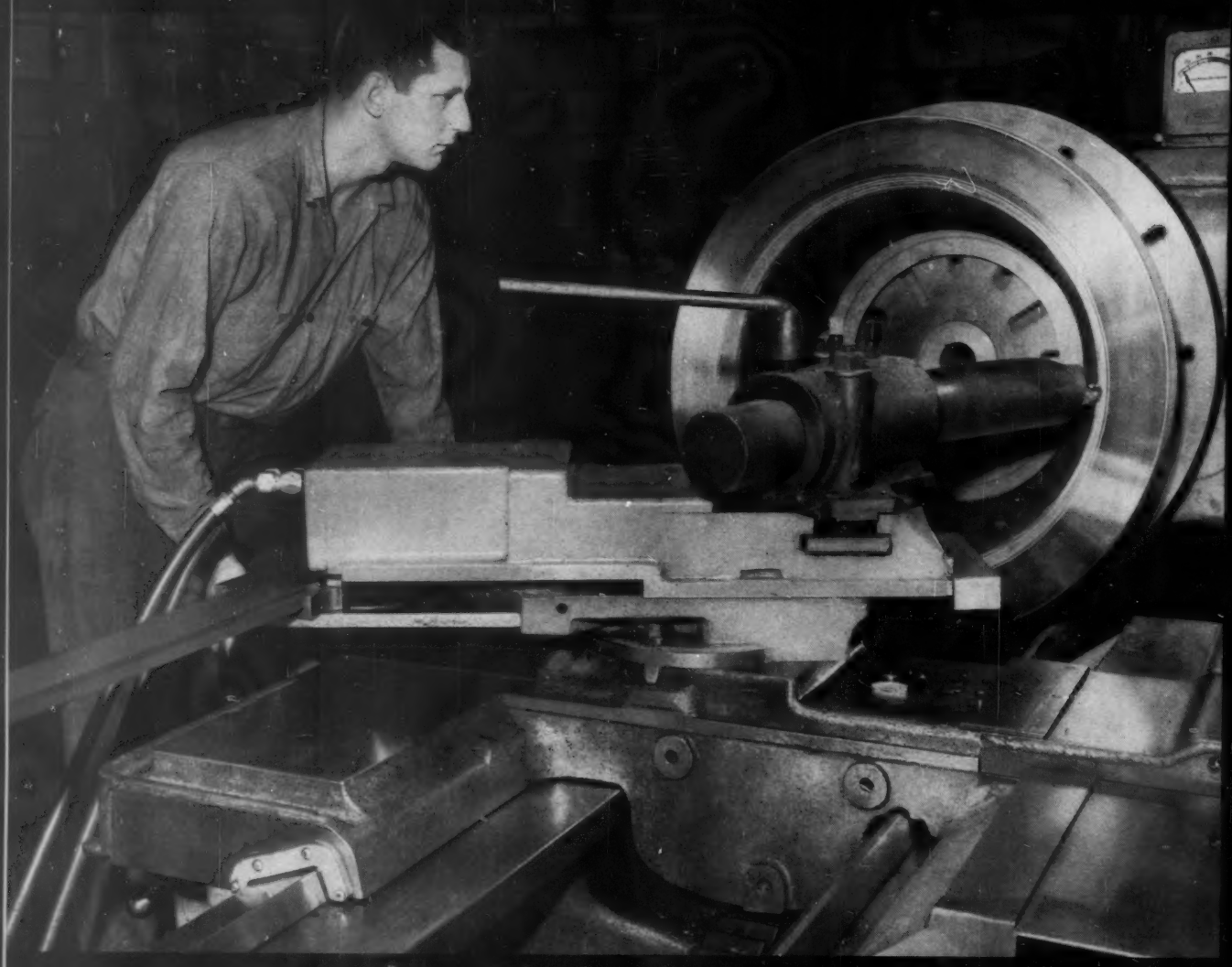
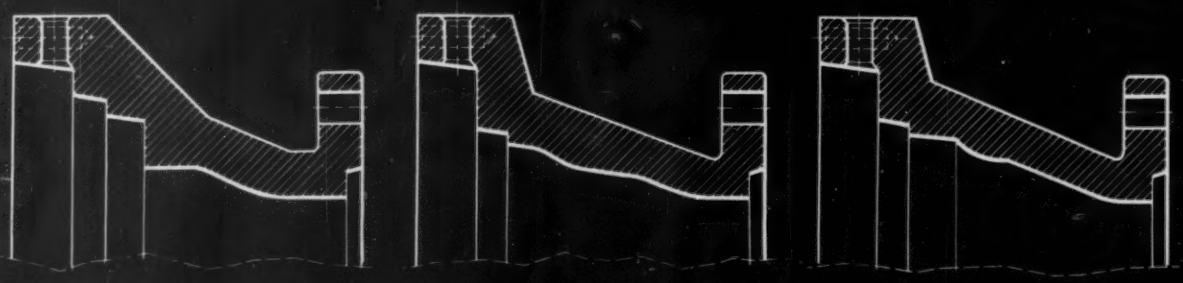
before you buy a tracing lathe,

find out how economically





you can . . .

add HYDRA-TRACE* to your Present LeBlond

American Cast Iron Pipe Co. did! Now they have all the advantages of a "new" tracing lathe, at a fraction of new-lathe cost. Actually, Hydra-Trace Duplicating Attachment is quickly and easily installed on most any LeBlond Lathe built since 1935.

This tracing-boring job at American Cast Iron Pipe Co., Birmingham, Ala., is a good example of Hydra-Trace performance. Bells for centrifugal pipe molds are machined internally with Hydra-Trace feeding at 30° angle. The part is finished in one-third time required for hand-fed turning. Details of the machining operation were worked out by LeBlond engineers, who prepared prints and template pattern for American.

LeBlond offers a wide variety of useful turning attachments. Because of the inherent stamina of LeBlond machines, our customers often solve special turning problems by adding to their present machine—good for many more years of dependable service.

Perhaps you, as a LeBlond Lathe owner, have a tracing job made to order for Hydra-Trace. Our field engineers are always on call, ready to work with you in solving your specific turning problems. Write today and tell us your needs.

*Hydra-Trace (Trade Mark registered U.S. Pat. Off.) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of compound rest on practically all LeBlond lathes built since 1935.

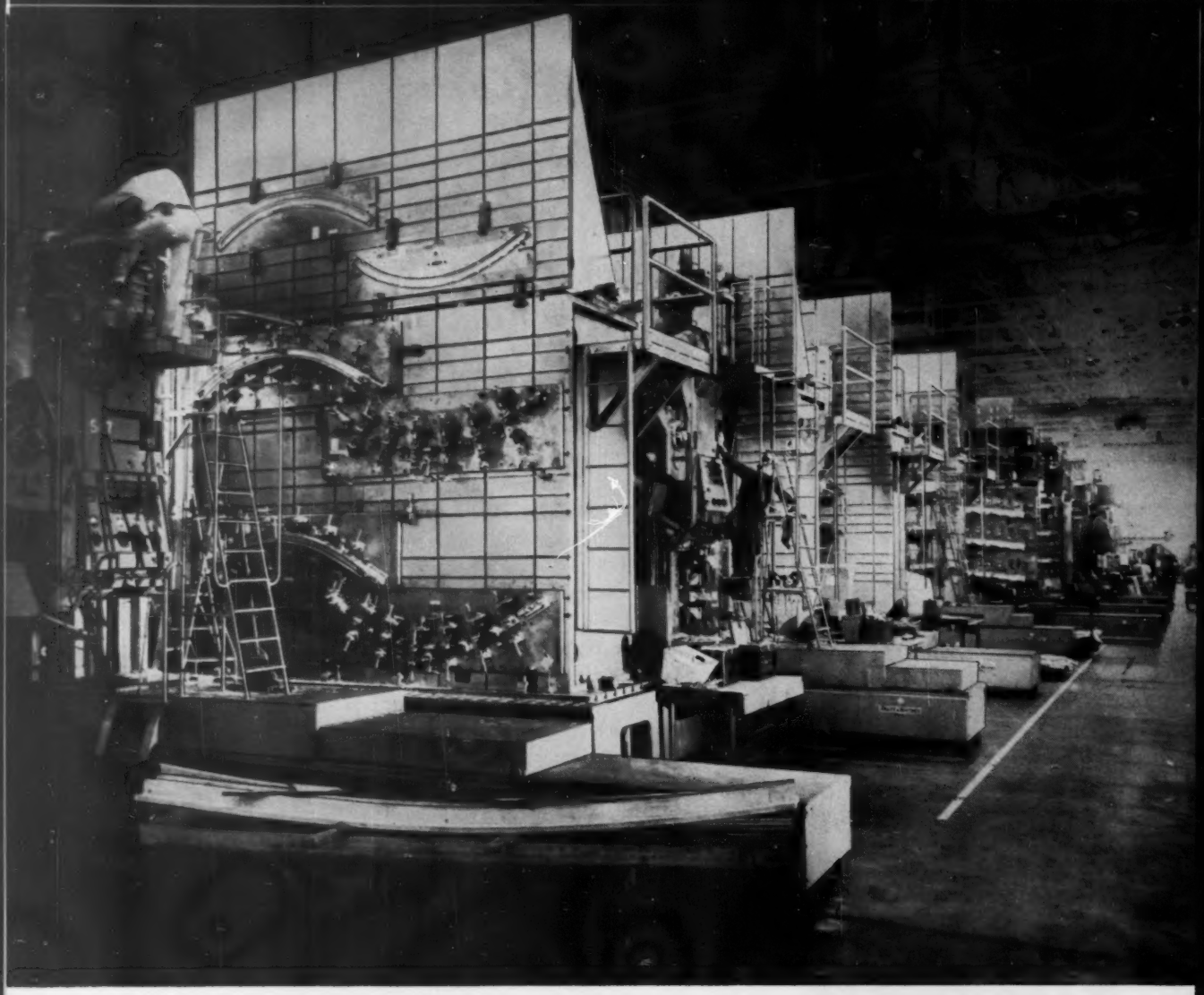
Simply adding HYDRA-TRACE made a tracing lathe of this five-year-old 32" LeBlond Heavy Duty—at small cost. These parts call for tracing-boring operation. Material #1025 steel; spindle speed 35 rpm; feed .016; carbide tool; finish 60 micro-inches; tolerance ±.0025. Machining time 3 hours, one-third time required for hand-fed turning.

. . . cut with confidence

LEBLOND of Cincinnati

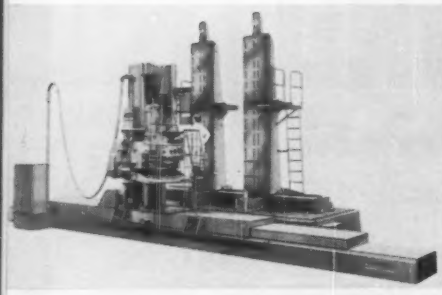
THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

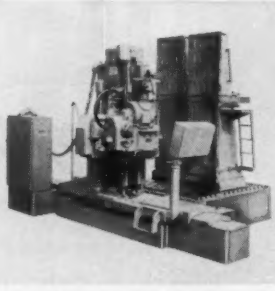
World's largest builder of a complete line of lathes for more than 69 years

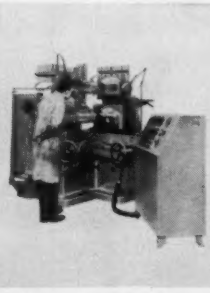


GIANT

shape the future





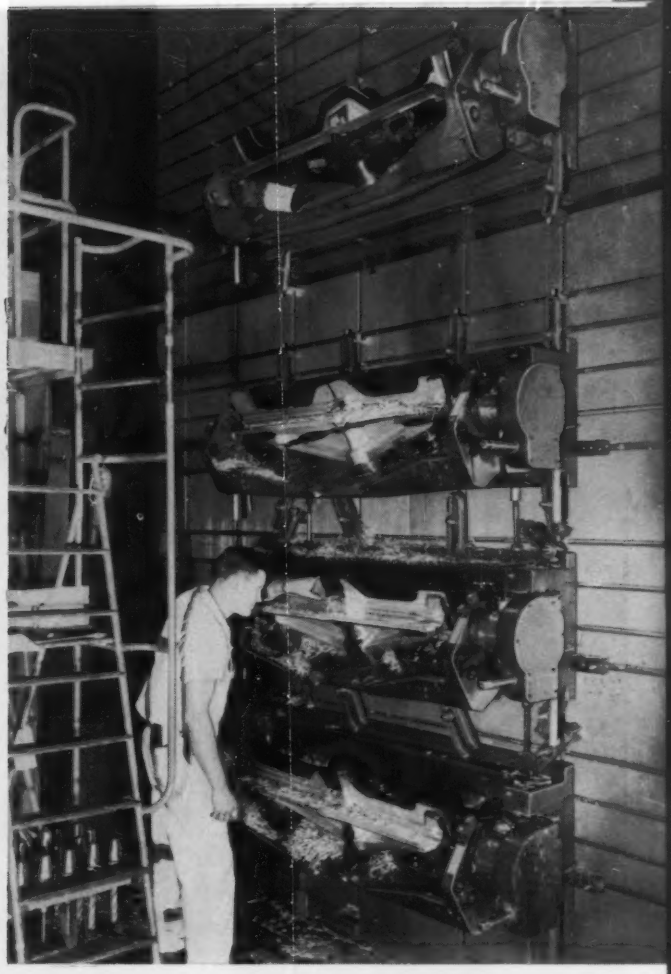


MULTI-MILLION DOLLAR PLANT... OR SMALL SHOP—There's a complete line of Pratt & Whitney KELLER Machines with models to handle *every* work size profitably.

TYPE BG-22—A big machine with capacities to 20′ x 7′. Single and 3-spindle models.

TYPE BG-21—Two standard sizes: 5′ x 2½′ and 6′ x 4′. Single and 2-spindle models.

TYPE BL–Smallest KELLER with capacity of 36″ x 20″. Single and 3-spindle models.



The use of two and three-spindle KELLERS provides rapid output geared to tight schedules. One noted manufacturer is counting heavily on KELLERS to help produce 150-foot airliner wings on a five-a-month basis and fill $90 million worth of orders.

Augmenting the already great versatility and productivity built into all KELLER Machines, Tool Engineers have developed ingenious trunnion fixtures (like those shown in the adjacent picture) that make it possible to re-position the components quickly for several successive machining operations . . . *without* production stops to remove the work and change fixturing.

KELLERS

of jet age production

These on-the-job scenes taken in the plant of a leading aircraft manufacturer typify the swing to KELLER throughout the Aviation Industry. To provide the maximum strength-with-lightness necessary to withstand the terrific stresses of jet age flight, increasing numbers of large, complicated components are being forged as single units and then machined over their entire surface. And making it possible to mill accurately all the complex, 3-dimensional shapes involved — on an efficient, production basis—are these rows of Pratt & Whitney BG-22 KELLER Tracer-Controlled Milling Machines . . . powerful, versatile giants that handle a wide variety of large workpieces.

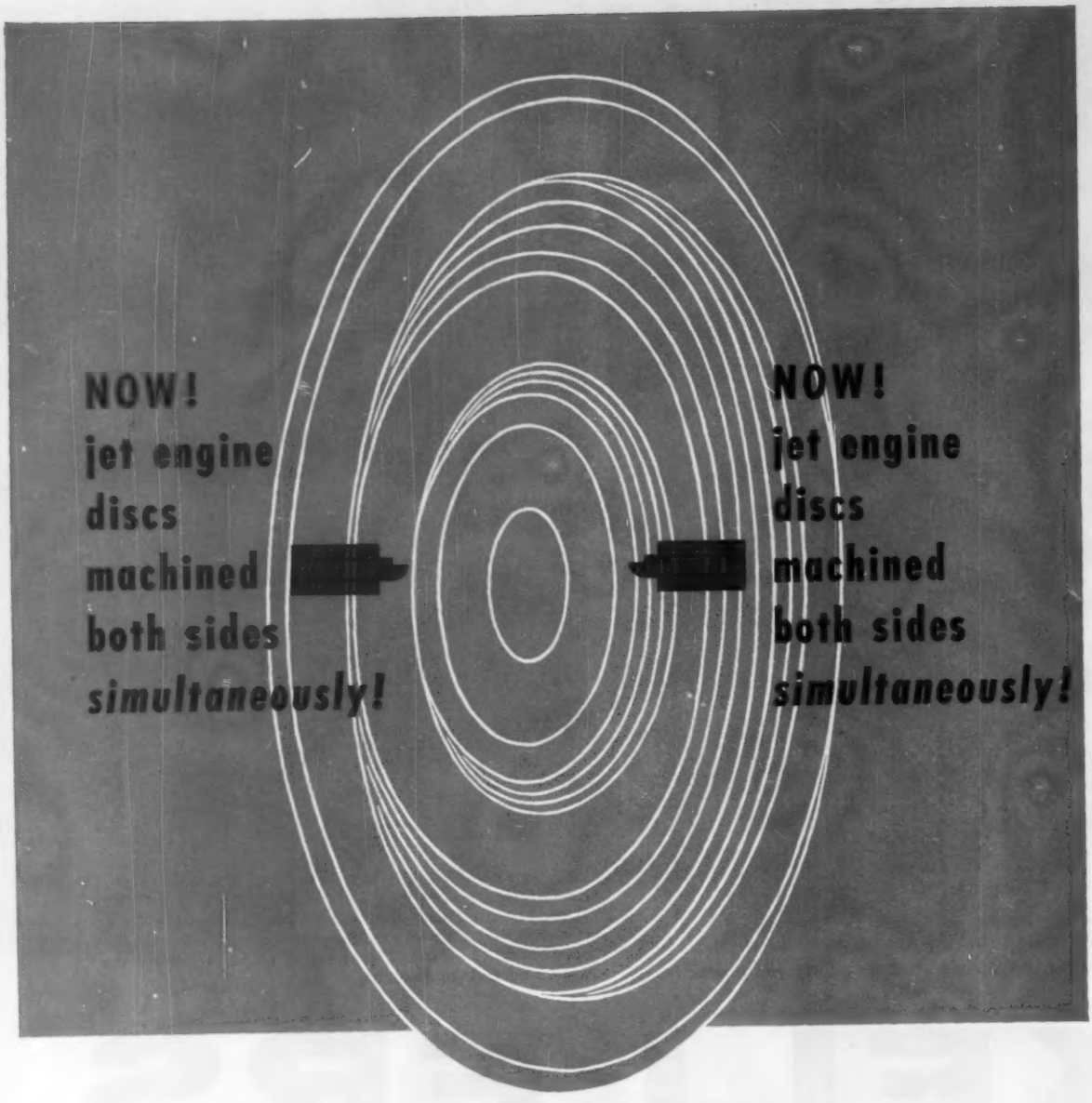
GET THE FACTS . . . See how PRODUCTION MILLING with a Pratt & Whitney KELLER Machine can help improve your product performance and cost picture. Write for fully illustrated circulars, stating your work size ranges . . . or phone the Pratt & Whitney Machine Tool Specialist in your area.

PRATT & WHITNEY COMPANY
INCORPORATED
12 Charter Oak Boulevard, West Hartford 1, Connecticut
Direct Factory Representatives in Principal Cities
MACHINE TOOLS • GAGES • CUTTING TOOLS

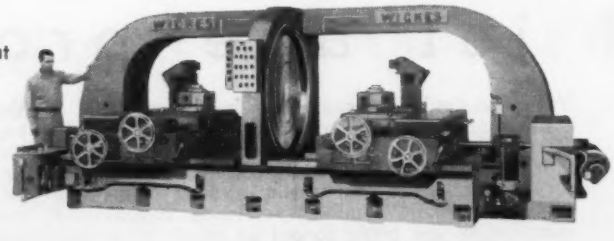
7'. Single and 3-spindle models.

Single and 2-spindle models.

Single and 3-spindle models.



WICKES, pioneers of the center drive principle, announce a center drive profiling lathe specifically designed to machine both sides of jet engine discs at the same time • Due to equalized pressure of tools on each side of disc, flatness, parallelism and concentricity are obtained that were never before possible • Single chucking eliminates stack up of tolerances • Controlled by 360° tracer • Constant cutting feet per minute and constant feed per revolution produce a highly superior finish • Stainless steel or titanium are readily machined in this set-up.



FOR MORE DETAILED INFORMATION ON THIS MACHINE WRITE US TODAY.

WICKES MACHINE TOOL DIVISION • THE WICKES CORPORATION • SAGINAW, MICHIGAN

OVER 100 YEARS' EXPERIENCE IN SOLVING PRODUCTION PROBLEMS

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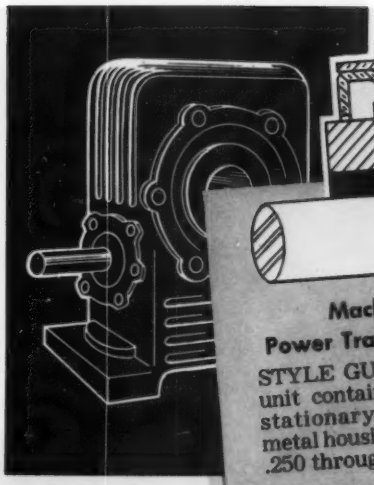
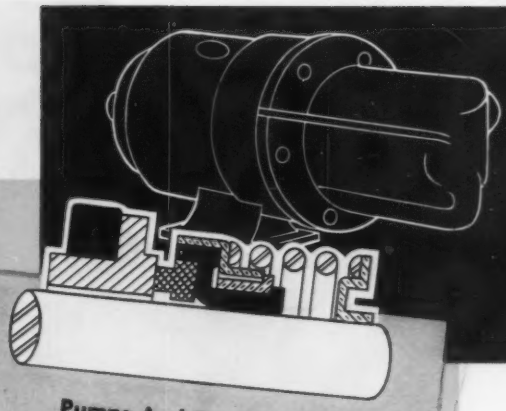


Machine Tools And Power Transmission Equipment

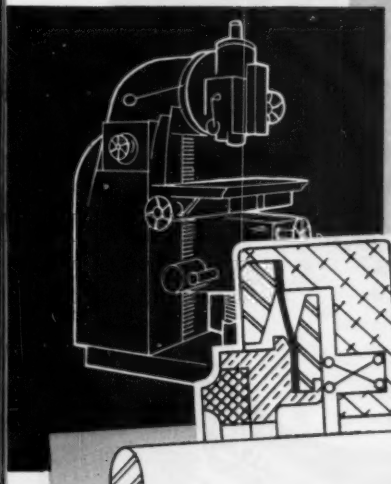
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

A Complete Line

GITS SHAFT SEALS

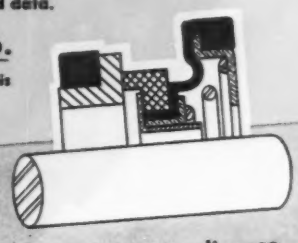
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

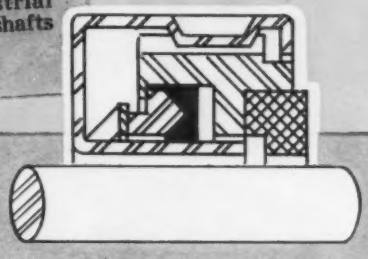
1864 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



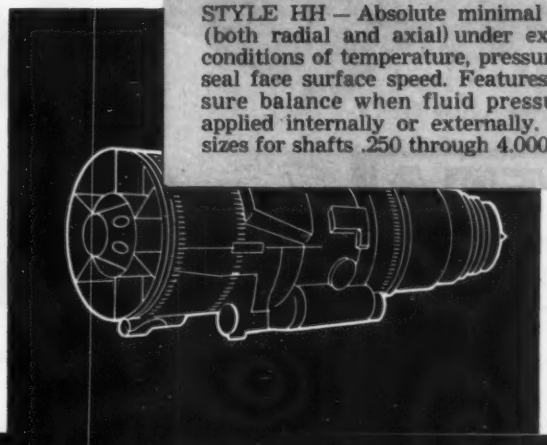
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

STABLE ACCURACY

The Most Important Requirement In Gaging

The basic design of the Dimensionair is different from that of any other Air Gage. It "repeats" measurements precisely and constantly hour after hour because —

1. The Dimensionair's balanced air system cancels out pressure variations which might affect it and cause errors.
2. Unlike other air gages, there is no adjustment in the magnifying-measuring side of the system. Rather than introduce a variable here which would make a fixed system impossible, Federal offers two magnifications which answer practically every requirement. These magnifications are 2500 to 1 and 5000 to 1. In this way, Federal achieves a stability which cannot be approached by other air gages.
3. Because the magnification is fixed, the scale is linear and the graduations can be accurately calibrated.
4. Hence, with no adjustment to change the magnification and affect the stability, only a single master is required.

Try It!

Check a Dimensionair yourself right in your own plant. Compare it with your present air gages.

a. **Check it for stability** or "repetition". Do this frequently and over long intervals, always using the same master. Avoid temperature effects (excessive handling, direct sunlight, etc.) Notice how quickly you can set the gage to zero.

b. **Check its calibration** using any number of masters. Confirm the fact that only one master is needed. See how dependable the Dimensionair really is.

Ask us or our salesmen to let you try a Dimensionair

Federal Products Corporation
61110 Eddy Street • Providence 1, R. I.

We'd like to test a Dimensionair in our plant.

Company Name.....

Your Name..... *Title*.....

Address.....

.....

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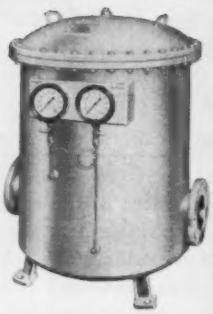
CFC COMPLETE FILTRATION COVERAGE

there's a Commercial Filters unit engineered for your filtering job...

Fulflo FILTERS



Fulflo Filters provide optimum clarity at ultra-high flow rates. For all industrial fluids—including oils, liquid fuels, chemicals, water, compressed air and various gases. Sizes to handle flow rates up to 1,600 gpm. Pressures to 4,000 psi.

Fulflo Filters feature Honeycomb Filter Tubes, the "precision controlled density" element that filters every drop again and again to give you microscopic clarity. Choice of cotton, acetate, nylon, orlon, dacron, dynel or glass fibres.

Standard models available in steel, stainless steel, rubber lined steel or nickel-plated brass. Custom models engineered to special requirements.

Honan Crane FILTERS

Honan-Crane Filters offer "clean oil" filtration in diesel, turbine, hydraulic, metalworking and quenching operations. Bulk refill models provide depth filtration with cellulose medium for additive oils and Cranite (fullers earth) medium for straigth mineral oils. Multi-cartridge models feature six different types of cartridges that may be used interchangeably depending on type and degree of filtration desired. Flo-Pac models, installed in line, handle flow rates up to 900 gpm. All have quick-opening covers for ease in changing refills.

other CFC products

Purivac Insulating Oil Conditioners
High Pressure Hydraulic Filters
Magnetic Separators
Plating Filters
Coolant Clarifiers
Oil Burner Filters
Compressed Air Filters
Dri-Pure Water-Oil Separators
Pre-Coat Filters
Water Filters
Beverage Filters
Pharmaceutical Filters
Automatic Tubular Conveyors

FILTERS Michiana

Diesel and gasoline engines get complete protection against the damaging effects of dirty oil with Michiana Lube and Fuel Oil Filters. Designed for low cost filtration and proven in thousands of installations. "Throw-away" or repackable filter elements. Available in a wide range of sizes and models.

Write for literature or engineering help covering your filtration problem.

CFC

COMMERCIAL FILTERS CORPORATION

MELROSE, MASSACHUSETTS • LEBANON, INDIANA

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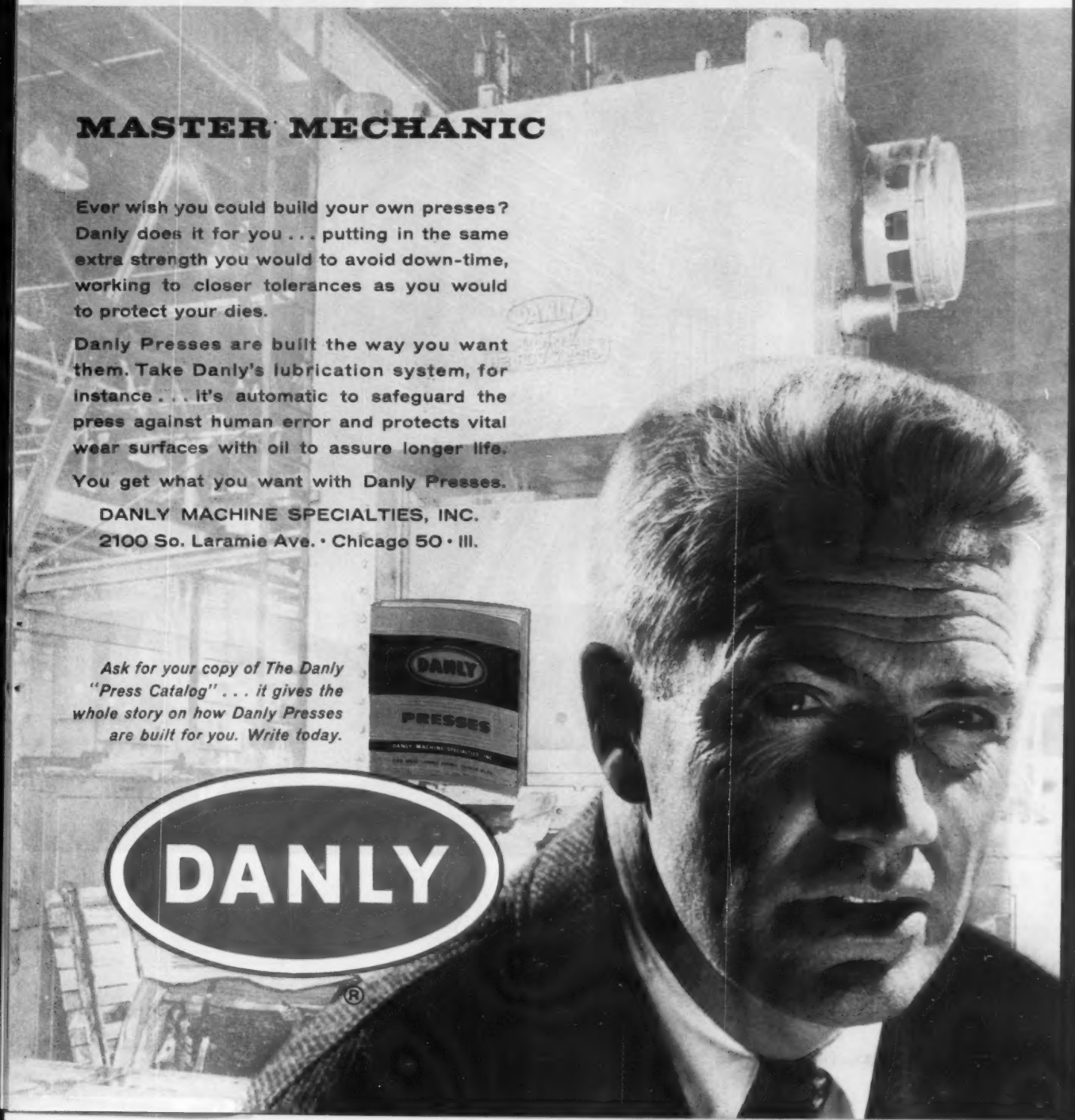
You get what you want with

DANLY



MASTER MECHANIC

Ever wish you could build your own presses? Danly does it for you . . . putting in the same extra strength you would to avoid down-time, working to closer tolerances as you would to protect your dies.

Danly Presses are built the way you want them. Take Danly's lubrication system, for instance . . . it's automatic to safeguard the press against human error and protects vital wear surfaces with oil to assure longer life.

You get what you want with Danly Presses. . . .

DANLY MACHINE SPECIALTIES, INC.
2100 So. Laramie Ave. • Chicago 50 • Ill.

Ask for your copy of The Danly "Press Catalog" . . . it gives the whole story on how Danly Presses are built for you. Write today.

DANLY
PRESSES

DANLY®

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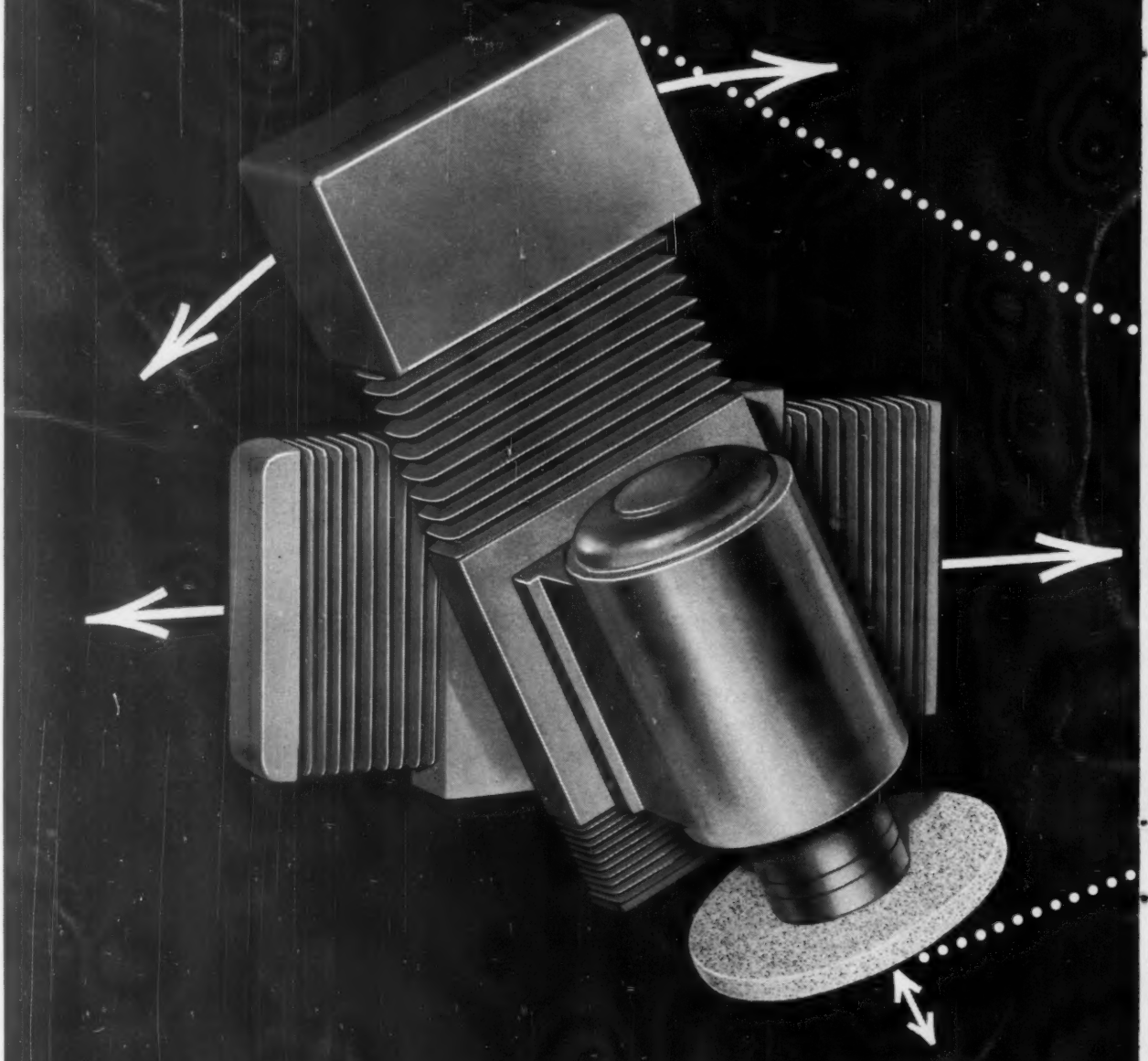
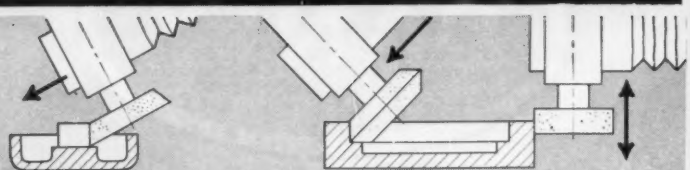
PRECISION GRINDING



Diagrams show typical applications of Frauenthal Standard Slide Units to a variety of grinding problems.



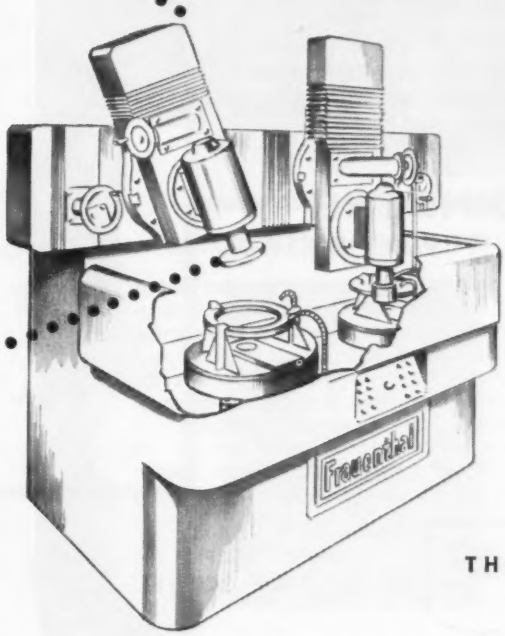
at any angle!

Frauenthal's creative engineering Now makes available Standard Slide Units in any number of combinations for production grinding applications . . .

IT IS NO LONGER NECESSARY to absorb special engineering and design costs when Frauenthal Standard Slide Units — plus a variety of grinding spindles — can be assembled to machine bases appropriate to a particular job. And these standard slides in single or multiple units can be arranged in an infinite number of spindle positions to accommodate an endless variety of simultaneous or sequenced, automatically controlled grinding operations.

What's more, you get all the advantages of Frauenthal's advanced engineering and design experience—proven on single and multiple-head grinders used on special production jobs. For example: parts for jet engines, diesel and automobile engines, tanks, gun mounts, radar units, large and small diameter precision bearings and machine tool components.

As illustrated here, this model of the versatile grinding compound shows how the Frauenthal Standard Slide Unit can be adapted to approach the work from any desired angle.

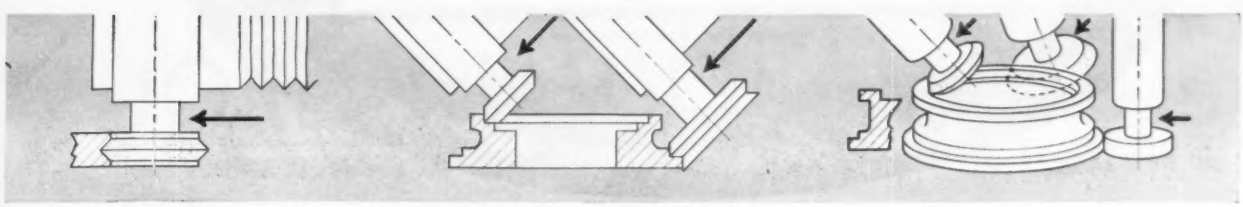


Here's a typical Frauenthal Double Head Vertical Spindle application utilizing two of the Frauenthal Standard Slide Units shown on the opposite page. Although applied to a particular grinding situation, these slide units retain versatility for angular positioning. Frequently, as indicated in panels 2 and 4 at the bottom of the page, diameters and adjacent surfaces are ground at one time with a single wheel dressed to the proper contour.

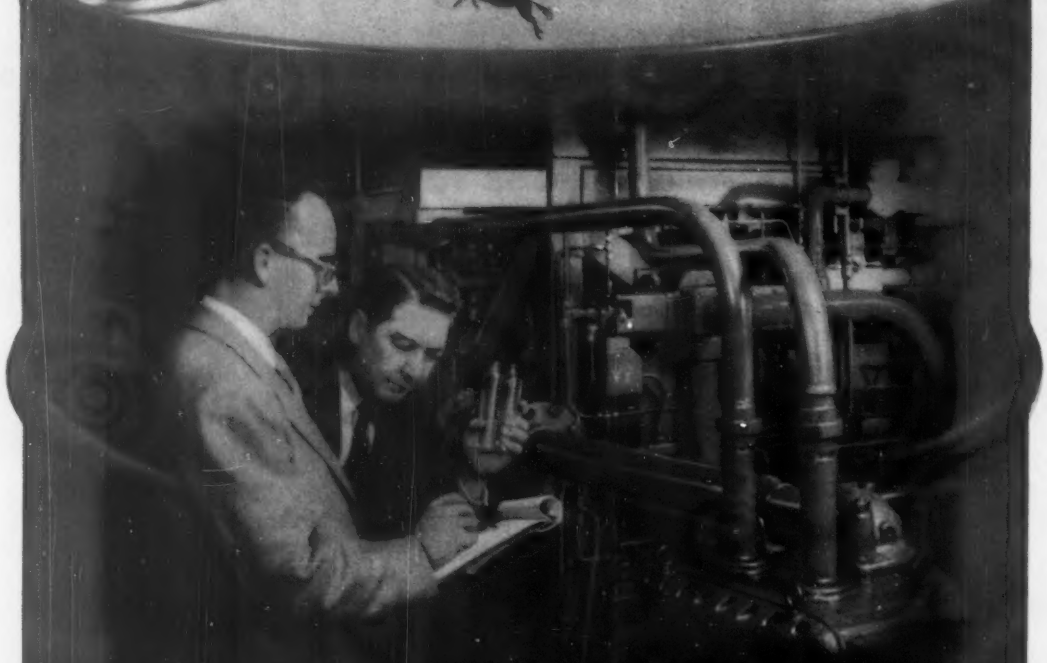
Send a print of your "problem grinding part" and our engineers will show you how to apply Frauenthal Standard Slide Units to solve the problem. Include in your letter pertinent production information — number of pieces, etc. Be sure to investigate the latest Frauenthal Vertical Grinders with Standard Slide Units. For complete details, contact Frauenthal of Muskegon.

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN, U. S. A.

F-256



There's more in this barrel for you...



James E. Pratt, left, Socony Mobil engineer, obtains performance data on hydraulic system at an aluminum extrusion plant.

MORE ENGINEERS

to help you improve production and cut costs!

Specify Socony Mobil and get the services of more industrial lubrication engineers than are provided by any other oil company.

These specialists, working closely with your Mobil representative, will help you set up a plant-wide program of correct lubrication . . . advise on any lubrication problems that might arise. Their long experience and expert recommendations can improve your production and cut costs.

Socony Mobil products are also backed by *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

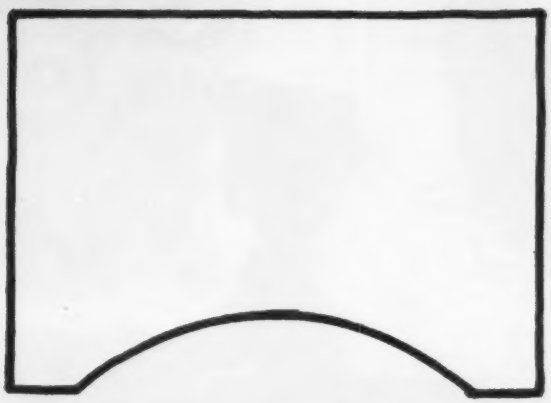
SPECIFY **SOCONY MOBIL** FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

DROODLES

by ROGER PRICE



"DRAWING BOARD FOR FAT DRAFTSMAN"

The "Comfy-Contour" drawing board was invented by my uncle Claude, an obese but brilliant man. He once had a fat commission to design new camel troughs for the Turkish government, and was rewarded with the honorary title of Emir Bey Windeau. Claude was very good-natured, and never beefed when we kids used his cummerbund for a pup tent. But, like all us talented people, he was sensitive, too. Like the time he thought his boss called him "clod". Claude up and belly-bunted him right over the office Coke machine. It wasn't a wise thing to do, but you had to admire his guts.

Another big development that wins admiration is the ever-increasing use of Jones & Lamson Optical Comparators. These precision-built instruments are being used throughout industry for measuring and inspecting all sorts of parts and objects. The J & L Comparator is accurate to .0001", and its versatility makes it equally suitable for both production-line and job-shop work. With a Jones & Lamson Comparator in your shop, you'll find you can perform inspections that just can't be done by other methods. Available in eleven bench and pedestal models. For complete information, write Dept. 710 *today*.

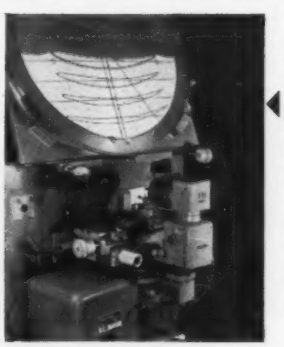
Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

JONES & LAMSON OPTICAL COMPARATORS *On the Job...*



Checking gages to close tolerances at Winslow Mfg. Co., Cleveland, Ohio

Templates used for manufacturing process are checked to tolerances of .0002". Standard Guillotine gages are duplicated from these "masters", for use by leading jet-engine makers in checking airfoils.

Multiple inspections at a glance at Zagora Gears, Inc., Charlotte, N. C.

Large capacity and ease of operation allow the inspection of oil grooves, shoulder lengths, several diameters; lead, pitch diameter and thread angle of thread and worm on these precision gear shafts *in one simple operation.*

JONES & LAMSON

World's Largest Manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

Granite City saves fuel, raises production and quality with Cities Service Heat Prover!

Nation's 14th largest steel producer uses Heat Prover on soaking pits, open hearth furnaces and on their annealing furnaces.

Granite City Steel burns enough fuel in one year to heat a five-room house for 38,000 years!

Obviously, if this fuel burns inefficiently, the loss could be staggering. But Granite City has no worries on that score. "Thanks to the portable Cities Service Heat Prover, we get better fuel efficiency, better quality, greater production than ever," they report.

"Because it provides a quick, highly accurate check of fuel-air ratio, the Heat Prover has proved invaluable in controlling combustion conditions in open hearth furnaces, soaking pits, and annealing and normalizing furnaces. In a matter of seconds it tells our engineers how efficiently the furnaces are working—whereas former tests often took hours and didn't provide as accurate a picture. Anyone in this business can probably benefit from this ingenious device."

Supplied and maintained free by Cities Service, the remarkable Heat Prover is today used and applauded by scores of major steel producers. If you'd like to learn how it could simplify your operation as it has theirs, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

20TH CENTURY BLOWGUN—a bazooka—is readied by technicians for tapping open hearths. They are part of Granite City's 4800 skilled employees.

HEAT PROVER AT WORK at back of open hearth furnace. In minutes it provides accurate check on furnace efficiency—saves hours required by former testing.

CONTROL TOWER at blooming mill guides ingots as they pass through rollers. Granite City has capacity of 1,200,000 net tons of ingots annually.

CITIES SERVICE

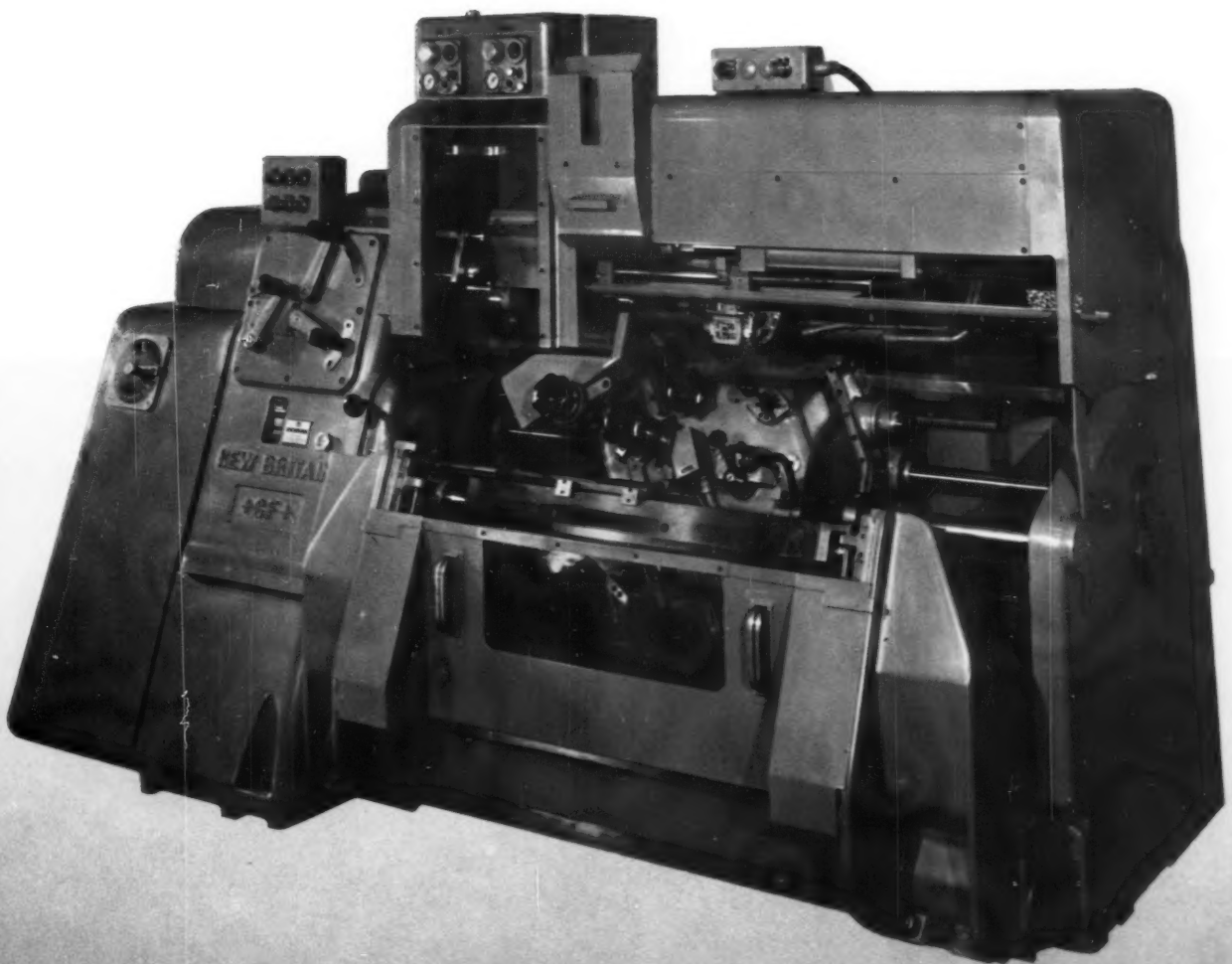
QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 263

old methods can't compete

If you do *any* turning you should investigate the New Britain **+GF+** line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.

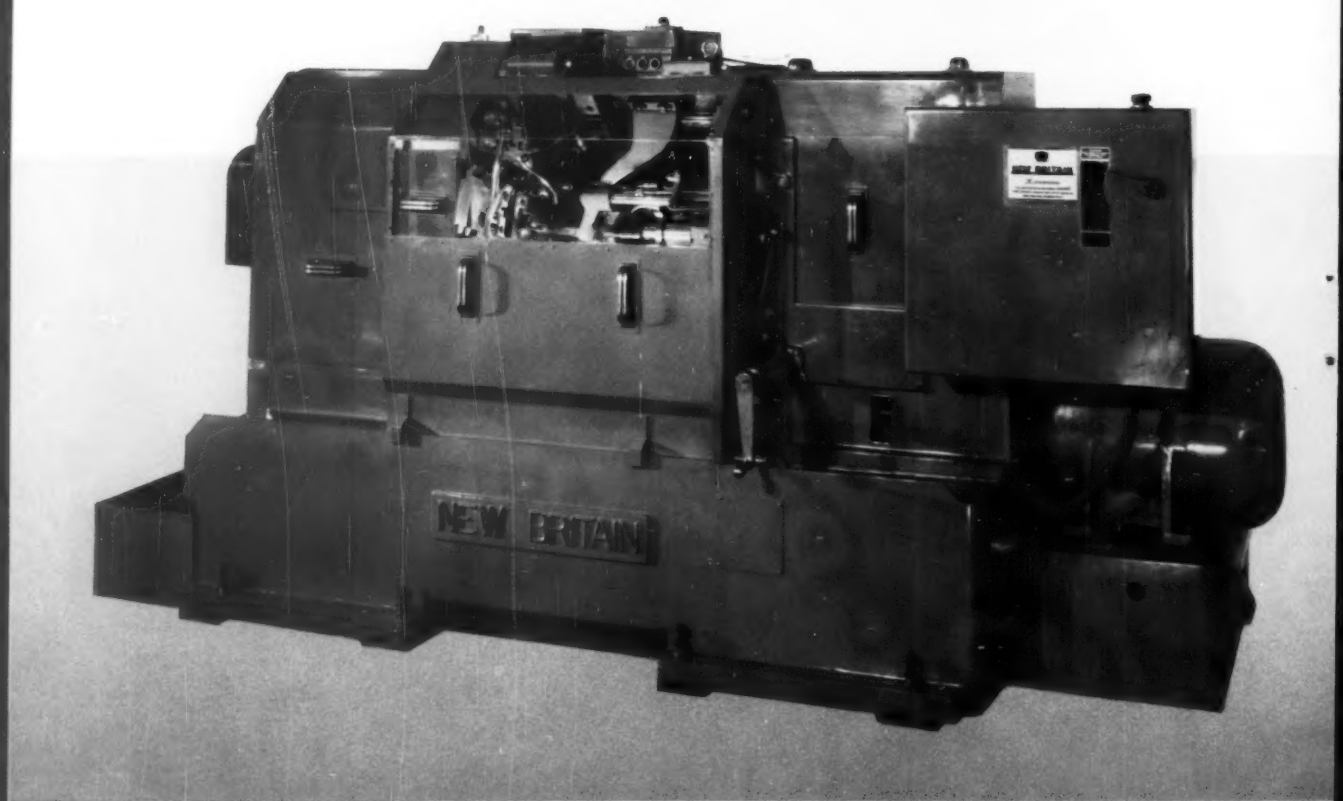
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



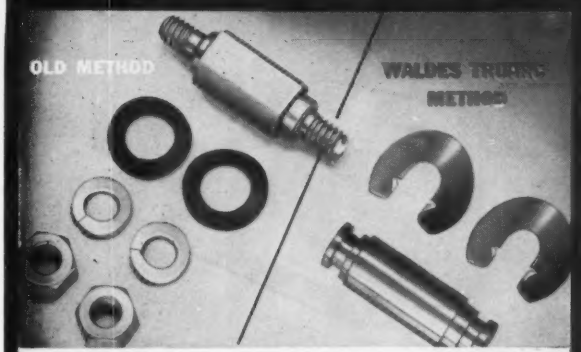
a long new step forward
in bar machine productivity

THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB

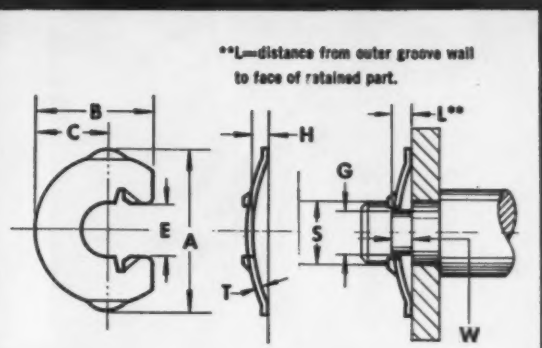
Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



New Waldes Truarc locking-prong ring functions as spring, shoulder, fastener... and STAYS PUT!



Above assembly shows how 2 Waldes Truarc Locking-Prong Rings (Series 5139) replaced 6 parts... eliminated threading operation... and need for skilled labor.



WALDES TRUARC LOCKING-PRONG RING (Series 5139)

U. S. Pat. Pending

Ring No. 5139-	SHAFT		RING DIMENSIONS												average ultimate shear strength lbs.*	GROOVE DIMENSIONS						resilient end play take up L max– L min
	Dia. S	tol.	A	tol.	B	tol.	C	tol.	E	tol.	H	tol.	T†	tol.†		Dia. G	tol.	Width W	tol. –.000	L min.	L max.	
12	.125	±.002	.340	±.010	.307	±.010	.166	±.005	.086	±.004	.050	±.010	.010	±.0013	400	.082	±.0015	.045	+.005	.035	.045	.010
★15	.156	±.003	.380	±.010	.330	±.010	.184	±.005	.108	±.004	.055	±.010	.010	±.0013	600	.104	±.002	.050	+.005	.035	.045	.010
18	.188	±.003	.445	±.010	.390	±.010	.213	±.005	.130	±.005	.060	±.010	.015	±.0015	900	.124	±.002	.065	+.005	.045	.055	.010
25	.250	±.003	.581	±.010	.500	±.010	.280	±.005	.172	±.005	.070	±.010	.015	±.0015	1000	.165	±.002	.070	+.005	.050	.065	.015
31	.312	±.003	.744	±.010	.620	±.010	.360	±.005	.234	±.005	.095	±.010	.018	+.001 –.002	1300	.228	±.003	.080	+.005	.080	.095	.015
★37	.375	±.003	.853	±.015	.740	±.010	.427	±.005	.280	±.005	.130	±.010	.020	±.002	1900	.270	±.003	.105	+.005	.090	.115	.025
★43	.438	±.003	.960	±.020	.820	±.020	.475	±.010	.327	±.010	.130	±.010	.020	±.002	2200	.327	±.003	.105	+.005	.095	.120	.025

Additional Sizes Under Development ★Production dies not available as of date of printing †Applies to unplated rings only *Recommended safety factor =3 to 4.

The Waldes Truarc Locking-Prong Retaining Ring is a new, low cost, radially applied fastener which can be locked positively in its groove and used as a shoulder against rotating parts. It is primarily intended for use in the automotive, electronic and aeronautical industries.

This radially applied ring locks positively in its grooves by means of two prongs at the open end. Because of its high thrust-load capacity the Waldes Truarc Locking-Prong Ring may be used as a shoulder against rotating parts. Its bowed construction provides for end-play take-up in the assembly and makes less critical the tolerances required for the parts being fastened. Since it serves as a spring as well as a shoulder, this ring eliminates the need for springs, washers, and other accessory fastening devices.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

SEND FOR FREE SAMPLES

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.

☐ Please send me sample Locking-Prong Rings. (please specify shaft size_____)

☐ Please send me supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.

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Name_____

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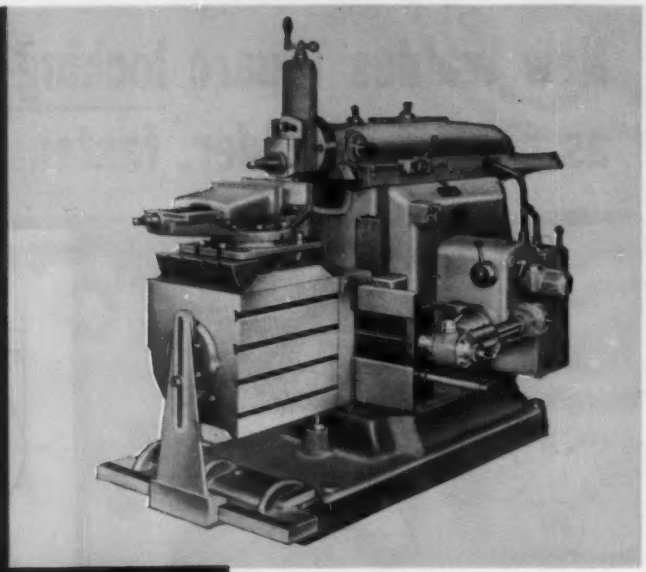
M 108

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787. and other U. S. Patents pending. Equal patent protection established in foreign countries.



VMA Universal Shaper Model ES-26

UTOMORDENTLIG YRKESSKICKLIGHET

(SUPERB CRAFTSMANSHIP)

VMA SHAPERS - built by Sweden's master craftsmen - are engineered to maintain precise tolerances in continuous heavy-duty production. Built to U. S. standards, VMA Shapers—both heavy duty and standard models — meet all requirements for modern versatile machines.

VMA Model ES Heavy Duty Shapers, available in Plain and Universal Models and with 18", 22", 26", and 28" stroke, feature:

- Wide selection of ram speeds and power feeds
- Automatic forced lubrication system
- Horizontal power rapid traverse of table through independent motor
- Double helical crank gear
- Chrome nickel steel transmission
- Anti-friction bearings throughout
- Dependable safety clutch

VMA Model EV Series . . . economical standard-duty Shapers with stroke lengths from 14" to 24".

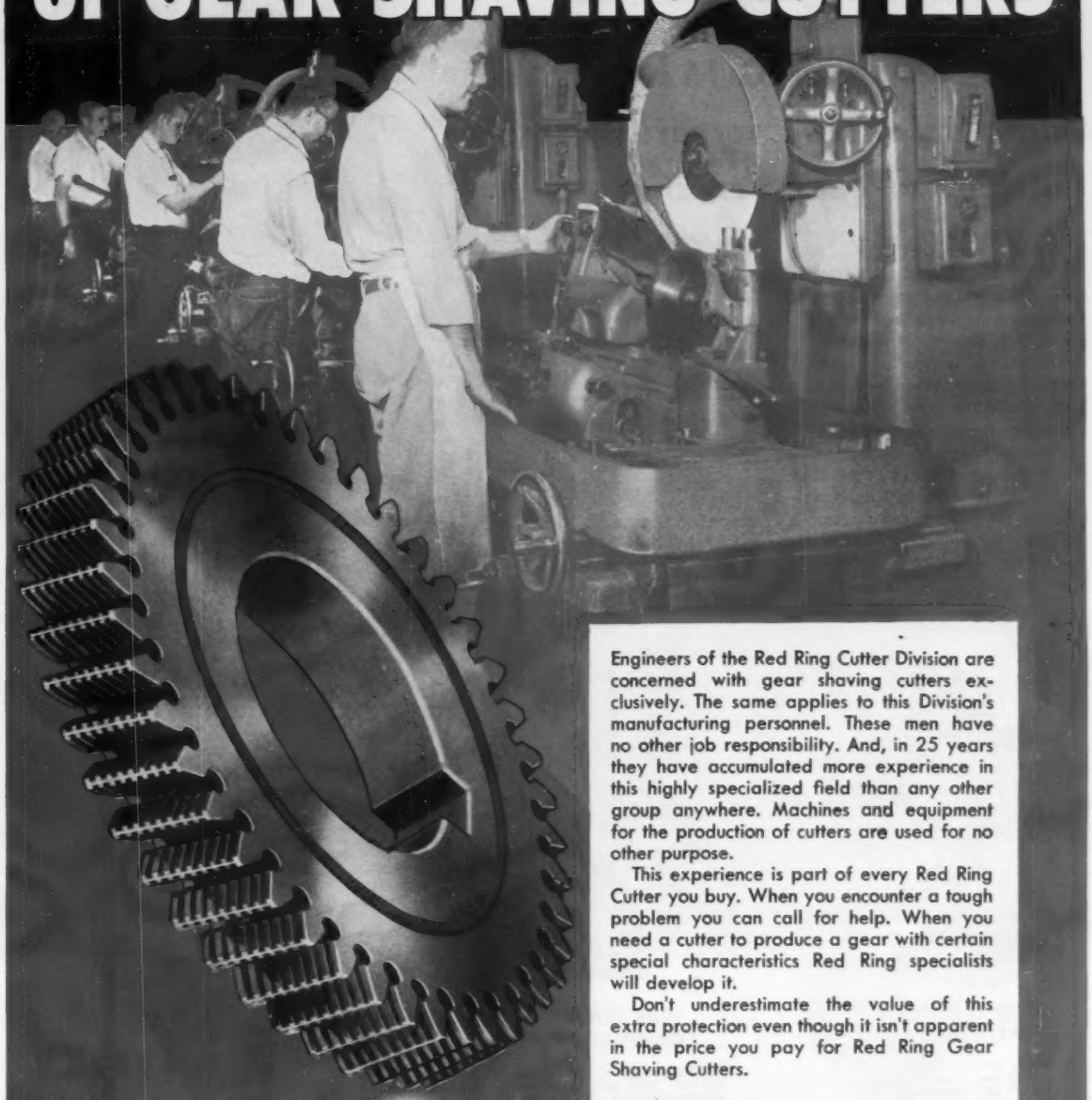
- Highly accurate and dependable, Model EV Shapers are ideal for job shop or tool room use not requiring the extra power of the ES Series. Easy to operate — economical to own.

austin

INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

A Tip to the Buyer of GEAR SHAVING CUTTERS



Engineers of the Red Ring Cutter Division are concerned with gear shaving cutters exclusively. The same applies to this Division's manufacturing personnel. These men have no other job responsibility. And, in 25 years they have accumulated more experience in this highly specialized field than any other group anywhere. Machines and equipment for the production of cutters are used for no other purpose.

This experience is part of every Red Ring Cutter you buy. When you encounter a tough problem you can call for help. When you need a cutter to produce a gear with certain special characteristics Red Ring specialists will develop it.

Don't underestimate the value of this extra protection even though it isn't apparent in the price you pay for Red Ring Gear Shaving Cutters.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information fill in page number on Inquiry Card, on page 263

ATTACHMENTS for Bridgeport

TURRET MILLING MACHINES

add outstanding versatility to a machine already versatile

WHEN you buy the BRIDGEPORT TURRET MILLING MACHINE, you buy more than a conventional vertical milling machine. You actually buy and get a machine of a type conceived, created and developed by Bridgeport. In addition to the turret principle originated by Bridgeport, attachments have been designed which add a great many features to the machine so that its basic purpose for milling, drilling, boring and shaping has been extended to include also cherrying, right angle milling as well as copying with the Bridgeport Hydraulic True Trace Combination.

One of the outstanding advantages of this machine is that you can buy this basic machine with some or all of these attachments or add them later whenever the need arises for the handling of specific operations.

Investigation of BRIDGEPORT TURRET MILLING MACHINES and their many attachments is always in order.

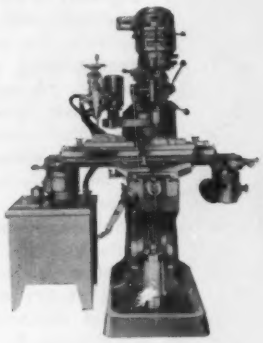
RIGHT ANGLE ATTACHMENTS

(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Above) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.

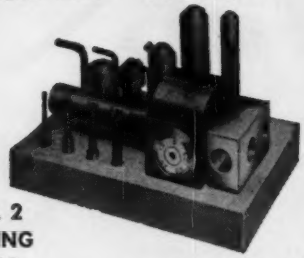
CHERRYING ATTACHMENT

Makes possible production of convex and concave shapes. Ideal for producing drop forge dies, molds, cavities.



TRUE TRACE COMBINATION

The Bridgeport True Trace Combination will give excellent performance and save endless hours when copying irregular dies and molds.



NO. 2 BORING HEAD

Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information fill in page number on Inquiry Card, on page 263

- more speed
- less waste
- greater accuracy

SIMONDS
ABRASIVE CO.

Cut-off wheels . . .

These thin, fast-cutting, resinoid-bonded wheels slice through the hardest-to-cut materials in seconds, giving more cuts per wheel — less stock waste — and essential accuracy in cutting lengths to close tolerances. They often eliminate finishing, too, since the ends they produce are smooth. Operating speeds from 10,000 to 12,000 s.f.p.m. (16,000 s.f.p.m. on specially designed machines.) Write for bulletin ESA-163 and name of distributor.

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.

CALL **YOUR SIMONDS DISTRIBUTOR**

LOCAL STOCK FAST SERVICE

Made with MAGNESIUM

DOW

A FEW POUNDS make a big difference when jigs have to be moved manually several times an hour.

MAGNESIUM FOR LOW-COST TOOLING

Lightweight magnesium tooling plate costs less to buy, less to fabricate and less to use

• **COSTS LESS TO BUY**—Magnesium tooling plate costs less than commonly used lightweight tooling materials.

• **COSTS LESS TO FABRICATE**—Magnesium jigs and fixtures are easy and economical to build, too. The reason is that magesium tooling plate is easy to machine, easy to weld.

• **COSTS LESS TO USE**—Magnesium weighs one fourth as much as steel and only two thirds the weight of aluminum. By making your jigs and fixtures with lightweight magnesium you'll increase worker efficiency and reduce lost-time injuries.

For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 397CC.

Available from stock at: **Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.**

you can depend on DOW MAGNESIUM DOW

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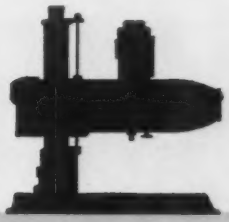
FAST SERVICE



NEW HEAD CONTROLS make Fosmatic Radial easier than ever to run!

Numerical Dials select feeds and speeds quickly, easily, with minimum possibility of error. Select even while drill is running, to save time on next operation.

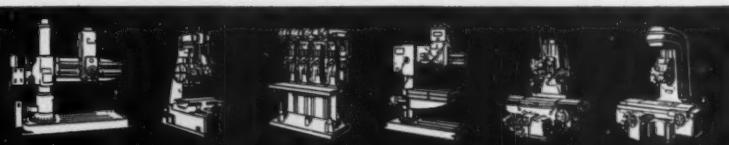
Single Control Lever starts, stops, reverses and shifts to feed and speed set on numerical dials.

Push Buttons on quick return levers engage feed. Feed is disengaged automatically by depth control or by pushing either button again. Magnetic clutch needs no adjustment.

Head Traverse Lever also elevates arm. Variable speed hydraulic motors drive both traverse screw and elevating nut. Clutches eliminated.

Other Fosmatic features include: 36 spindle speeds, 18 feeds, 4' to 8' arms, 13" to 19" columns, Boring Type Spindle, Safety Interlocks, Variable-Tension Counterbalance for Spindle, and optional Milling Feed.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

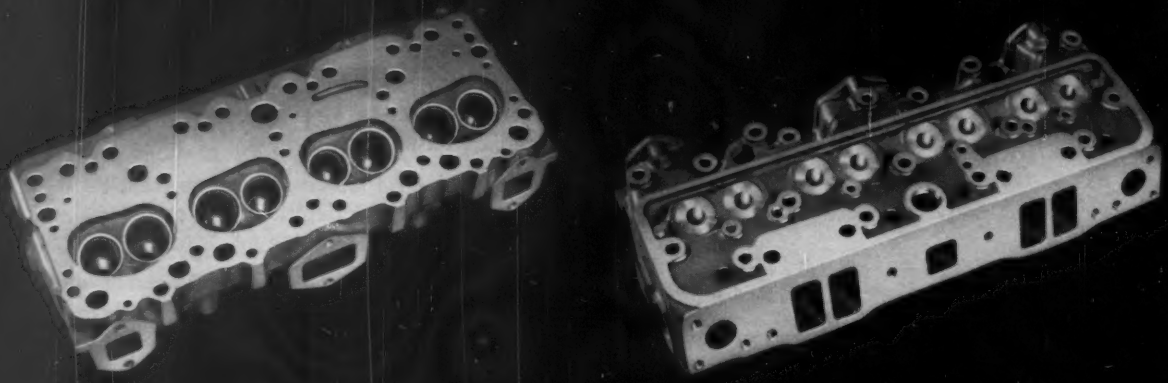
THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

Introducing

Sectionized Automation with *Automatic Banking* for V-8 Cylinder Heads

Section III



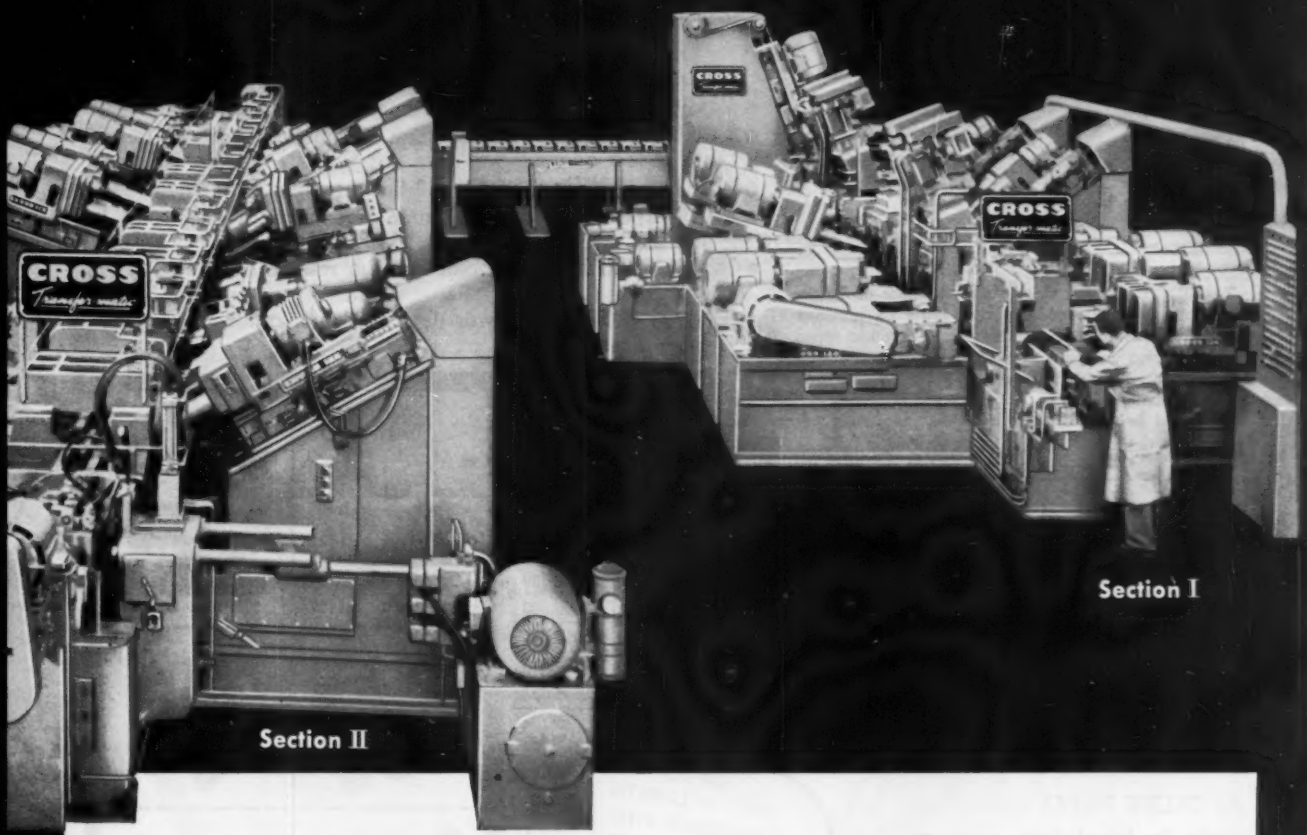
Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

Another Automation First by Cross



This *Sectionized* Transfer-matic for machining V-8 cylinder heads is the first in the industry to utilize automatic banking to reduce downtime.

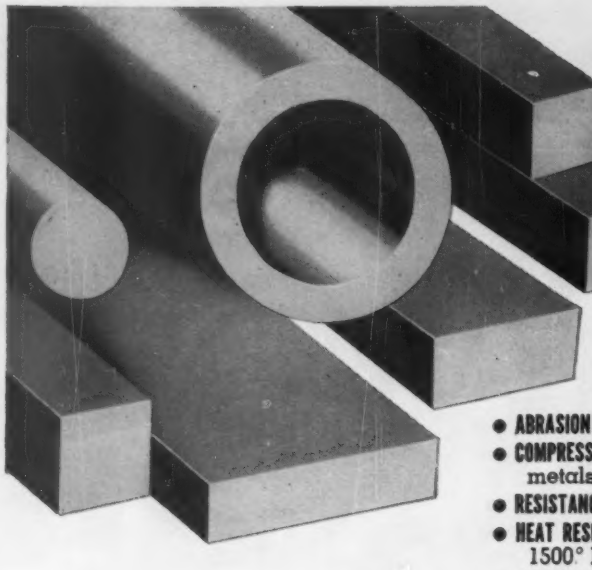
Key to the increased operating efficiency of this machine is its division into three sections and the use of two banking units—one at the rear between Sections I and II and the other in front between Sections II and III.

The first banking unit holds up to 35 pieces and feeds Section II. The second feeds Section III.

If production is interrupted in Section I for tool changing or maintenance, Sections II and III continue to operate as they receive parts from the two banking units. If Section II is stopped, the first banking unit stores the overflow from Section I and the second unit continues to feed Section III. If work in Section III is interrupted, the second banking unit receives and stores the parts from Sections I and II. The ability to shut down any one of the sections while the others continue to operate results in greatly increased production efficiency.

The entire line performs 461 operations on each of 144 cylinder heads per hour at 100% efficiency—213 in the 11 stations of Section I, 154 in the 16 stations of Section II and 94 in the 13 stations of Section III. This completes all operations except broaching.

Other features are: Construction to JIC standards, hardened and ground ways, automatic lubrication, automatic chip disposal, pre-set tooling throughout and Cross Machine Control Units to program tool changes.



HARDEST MAN-MADE METAL

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain and shock are destructive to other metals.

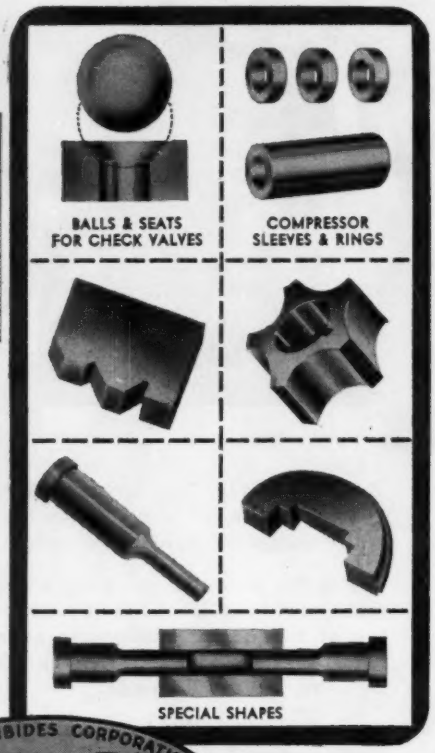
- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, mining and metal-working industry. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.



All TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch.

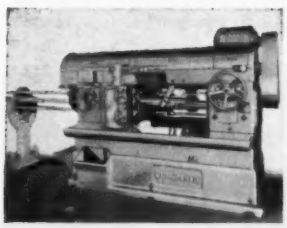
Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 76-page catalog 56-G or ask for sales engineer to call.

UP TO 100" IN LENGTH EXCLUSIVE WITH METAL CARBIDES
METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

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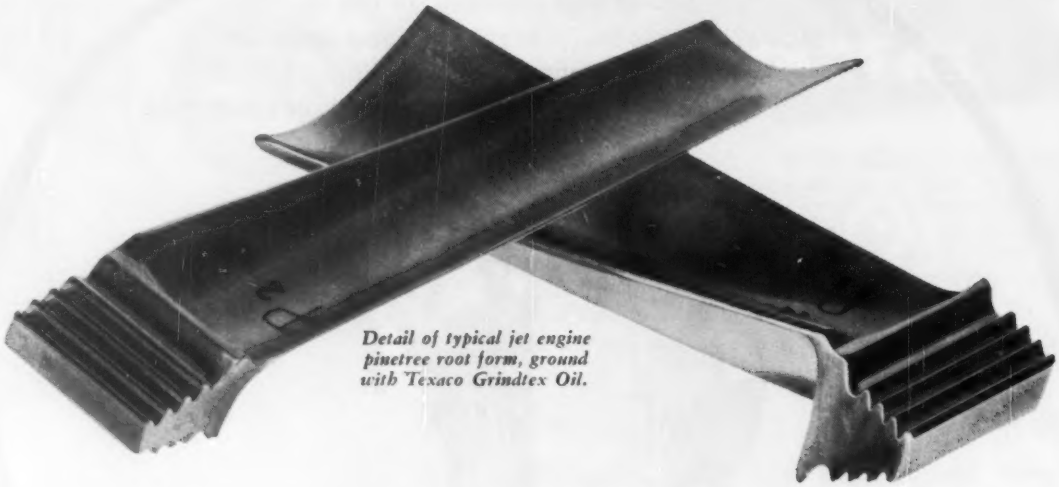


Detail of typical jet engine pinetree root form, ground with Texaco Grindtex Oil.

Grinds more "pinetrees" between wheel dressings

UTICA DROP FORGE is one of the country's top producers of jet engine blades—doing the complete job from vacuum-melting the alloy to precision forging and finishing.

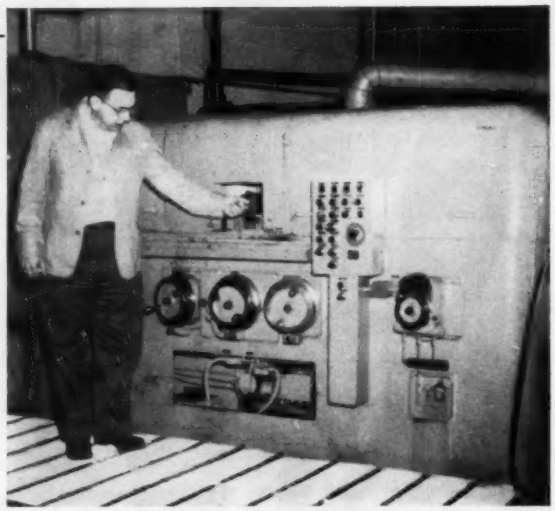
For the critical form grinding of pinetree and dovetail roots, as well as air foil contours, a Texaco Lubrication Engineer recommended *Texaco Grindtex Oil*—and its use has proved outstandingly successful.

Utica Drop Forge finds *Texaco Grindtex Oil* an important help in holding to the required close tolerances and achieving consistently excellent finish. Wheels last longer and fewer dressings are needed. These benefits add up to a higher output of perfect parts at a lower unit cost.

Be sure you're getting the most from *your* machines. There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do *all* your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.



One of the Ex-Cell-O Precision two-wheel form grinders at the Clayville, New York, plant of Utica Drop Forge & Tool Corporation. Adapted Norton and Thompson grinders are also in use. Metals worked are Nimonic 80 and 90, Iconel 700, Stellite and stainless steels. *Texaco Grindtex Oil* is doing a great job here.

VISIT Texaco Booth 1602, Metals Show, Cleveland, October 8-12

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

For more information fill in page number on Inquiry Card, on page 263

- Project Kittyhawk
- Machine Tools and the Highway Program
- Humidity-Controlled Storage

Keeping up with Washington

By Loring F. Overman

WITH the political conventions past history and Congress out of business until January 3, what Washington doings are of greatest concern to the machinery industries? Let's look:

Project Kittyhawk

They're saying in Washington that test runs of the nuclear-powered *Nautilus* are the forerunners of industrial changes greater than the air age ushered in by the first flight of the Wright Brothers. Possibly greater too, it is said, than the changes resulting from perfection of the automobile. "A whole new vista of technical requirements is emerging," observed Rear Admiral H. G. Rickover, chief of the Reactors Branch, Division of Reactor Development of the Atomic Energy Commission. "Just as the invention of the automobile opened up a need for a host of new industries—such as petroleum, glass, rubber, and highway construction—so does the *Nautilus* signify the start of many new technological advances in the Navy, and thus, inevitably throughout industry."

Admiral Rickover predicted the Navy's quick changeover from steam to nuclear power. He said: "In the early 1960's, all major vessels authorized will have nuclear power. First, many companion accomplishments will be necessary . . . the shipbuilder is faced with an entirely new order of structural and arrangement problems, because in a nuclear-powered ship the reactor must be completely integrated with the hull, just as the engine and the frame of a fighter plane must be designed together."

Some of the problems of the future, as suggested by Admiral Rickover in his forecast of the influence of nuclear power, are already being encountered by concerns operating some of the country's heavy presses. For example, the need of developing die steels capable of standing up under very high temperatures.

Machine Tools and the Highway Program

Ever cognizant of the importance of the machinery industries to defense and to peacetime industry—but often at a loss as to what to do about it—Washington is now talking of tax aid through rapid amortization of production facilities. Step-up of jet-engine production is cited as a reason for more machine tools. Highway-program expansion calls for outsize construction machines.

Tax aid under current programs has been reserved for companies planning to devote new capacity 100 per cent to defense production. New tax speed-up would permit rapid amortization of half the cost of new equipment, for example, if that percentage of plant production went to defense output.

Equipment Storage

Defense Department Instruction 4145.15 authorizes increased use of humidity-controlled storage space for machine tools, scientific instruments, and similar equipment. The purpose is to drastically reduce maintenance costs. Humidity-controlled space is authorized when such use:

(1) Permits technical and other materiel highly sensitive to moisture to be stored in a state of readiness for immediate use.
(2) Permits a reduction in the cost of initial preservation or represervation of materiel.
(3) Affords a significant reduction in either the reactivation time or cost of materiel or both.
(4) Maintains the condition of any materiel being held in temporary storage while awaiting repair, disposition, preservation, represervation, or assembly of components.
(5) Affords supplemental protection to materiel already subjected to preservative treatment.

Washington Briefs

To rush completion of the ICBM (intercontinental ballistic missile), seventeen prime contractors are working in four major areas. Six contractors are working with guidance systems, four on airframes, three on power units, and the rest on nose-cone problems and fuels.

The Army has completed the largest static firing test stand for rocket motors in the United States and possibly in the world. The stand—which took two and one-half years to build and cost $12,000,000—can test rocket motors for the 1500-mile IRBM (intermediate range ballistic missile) and, perhaps, for even more powerful missiles.

The Office of Technical Services has asked the Inventors' Council to study six problems encountered in the construction and operation of helicopters. One involves a means of inspecting structural joints formed by bonding metal components with resin or other types of metal-to-metal glues. Says the Department of Commerce, "for further information, write to NIC, Department of Commerce, Washington 25, D. C."

Planning a nuclear reactor? You'll need the new 478-page manual, "Reactor Shielding Design Manual" (TID-7004). It answers such how-to-do-it questions as setting allowable radiation levels; shielding the reactor core and cooling system; plant layout and other factors affecting shield design; effect of geometry of radiation; and similar data. The report is offered at $2.10 per copy by OTS, Commerce Department, Washington 25, D. C.

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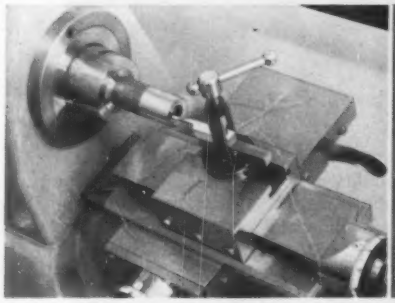
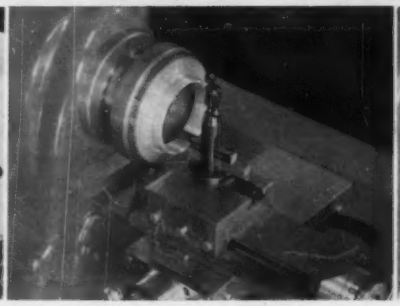
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

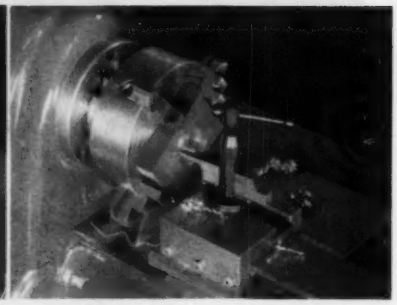
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".

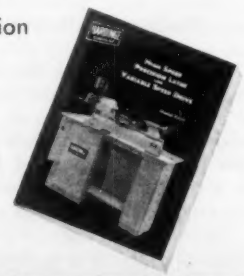


Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1¼" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV 59 High Speed Precision Lathe.

Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 3500 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results



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"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

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MACHINERY
OCTOBER 1956

A Business Administration?

IN the heat of an election campaign it is, unfortunately, a common practice of politicians to make extravagant statements that have little or no basis of truth. Constant repetition of charges against the opposing party, no matter how unfair, makes an impression on large bodies of the electorate and probably influences a considerable number of votes.

During the present campaign, the accusation has been made time and again by vociferous opponents that the Administration is "a businessman's administration." The claim is made that the Administration is not operating in the best interests of other facets of the National economy, particularly labor.

What are the facts? In July there were over 66,500,000 civilians at work, an all-time record, and 2,500,000 more than one year earlier. The cost of living increased only 1 per cent since May 1953, whereas the average hourly earnings in the manufacturing industries went up 10.5 per cent and fringe benefits have been increased materially. Any fair-minded person will agree that the working man is much better off than he was before President Eisenhower went into office.

On the other hand, corporate profits exceeded $22,000,000,000 in 1950, and, despite the Korean inflation and the growth of the National economy, they did not again equal that figure until the first quarter of this year. Obviously, any political orator who declaims that the Administration has shown partiality to business to the detriment of the working people is either woefully ignorant of the facts or is deliberately misrepresenting them for political purposes.

But then, as a nineteenth-century sage once commented: "Purification of politics is an iridescent dream."

Charles O. Herb

EDITOR

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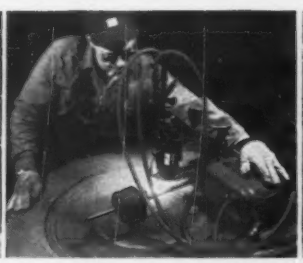

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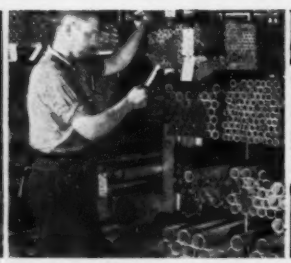

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OPERATION "BIG SQUEEZE"

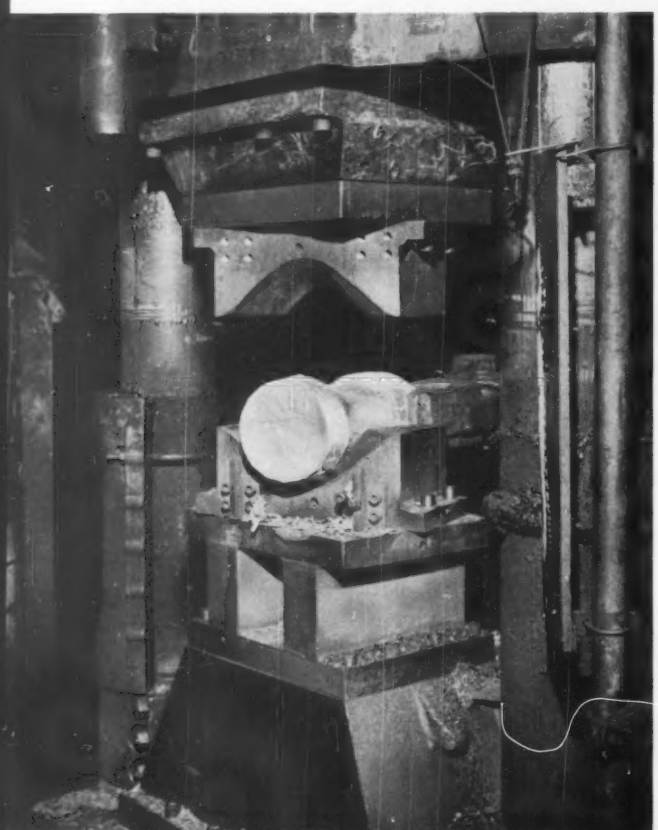
An 11,000-ton multiple-ram press is being used with the split-die process to turn out large nozzle forgings for the "Nike" guided missile. Two horizontal rams, as well as standard vertical rams, reshape the heated slugs in a Herculean all-around squeeze play.

By R. D. Springer
Special Products Department
Cameron Iron Works, Inc.
Houston, Tex.

WITH the production of guided missiles well under way in this country, CONAD (Continental Air Defense) is now capable of throwing up a multiple-weapon barrier 10,000 miles long and reaching a height of more than ten miles. One of the principal weapons in this defensive network is the "Nike," a radar-guided missile developed by the United States Army. This missile is capable of tracking down and destroying bombers at a range of twenty miles, regardless of evasive action taken by the target plane. Nozzles for these as well as for other guided missiles are being produced in quantity by the Cameron Iron Works, Inc., Houston, Tex.

Fig. 1. Finish-machined nozzle forgings for use in "Nike" guided missiles are stacked on pallets awaiting shipment.

Fig. 2. Heated forging slug for a "Nike" guided missile nozzle is shown being preformed to an hourglass shape.



"Nike" nozzles, which can be seen in Fig. 1, are made of FS-E4135 steel with a specific Jominy hardenability range. Since the machined piece is required to have a highly finished surface and also must be capable of withstanding critical temperature and pressure tests, it is desirable to produce the component as a forging. In addition to the economic advantages of machining high-quality forged pieces, the grain of the metal in forgings can be controlled and internal defects, such as porosity and inclusions, eliminated. Just as critical in manufacturing missile nozzles are the factors of production speed and labor cost. Lack of heavy-duty forging facilities, of sufficient capacity to handle the large nozzles, demanded that some production problems be quickly tackled.

Parallel Forging Problems Previously Encountered with Oil-Well Equipment

A similar problem had been worked out earlier in meeting the unusual demands of the booming oil industry. Deeper wells have introduced the factor of increased pressures. Today, oil-well control equipment must be capable of functioning efficiently while withstanding working pressures that soar as high as 15,000 pounds per square inch. The company specializes in manufacturing this type of equipment as well as valves that are required to operate at temperatures running as high as 1600 degrees F.

In searching for an economical method of producing components for oil-well equipment, Cameron considered the advantages of steel forgings. Unfortunately, the equipment to press-forge pieces weighing up to 5000 pounds and having irregular contours both in the bore and on the periphery did not exist.

To meet these conditions, research was undertaken on the possibility of using split, instead of closed, dies by applying horizontal forces from opposite directions in addition to the conventional down-acting force. The method proved practical, and the A. B. Farquhar Division of the Oliver Corporation, York, Pa., was commissioned to build a press having a capacity of 5000 tons on the down-acting ram and 2000 tons on each of the two side rams. Immediate results surpassed expectations and, as a result, plans were projected for the construction of a larger press of the same general type.

Large Forging Press Exerts 11,000-Ton Squeeze

The Eddystone Division of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., has constructed a huge multiple-ram forging press weighing 3,100,000 pounds. Including the sub-floor

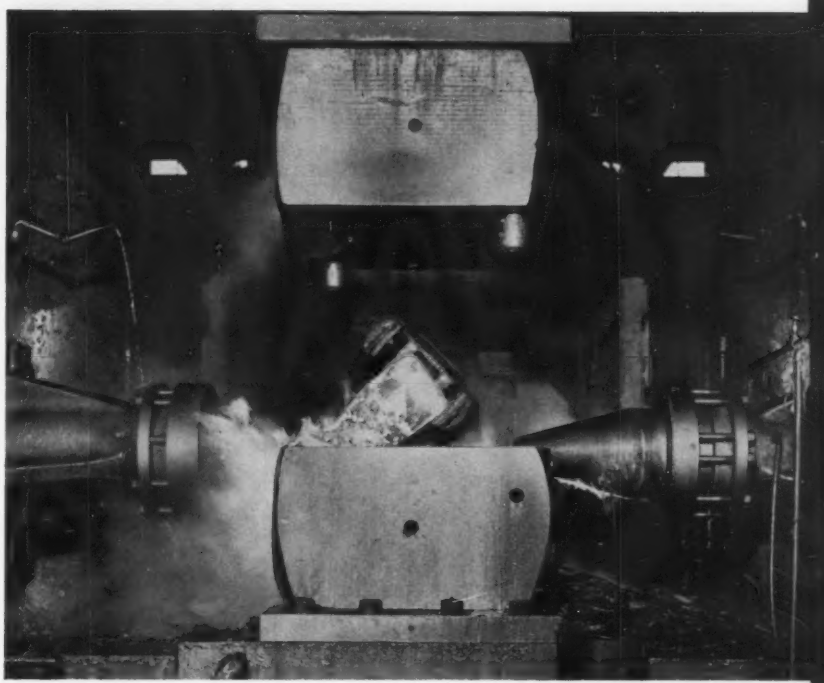


Fig. 3. The preformed slug is illustrated being placed in the lower half of a horizontally split die on an 11,000-ton capacity multiple-ram forging press.

structure, this press—which can be seen in the heading illustration—is more than six stories high. It is a hydraulic machine with an air-hydraulic accumulator system capable of providing 11,000 tons available pressure on the main, or down-acting, ram and 6000 tons available pressure on each of the two side rams.

Each of the side rams has an operating stroke of 24 inches. The down-acting ram has a 60-inch stroke and is equipped with an internal ram of 3000 tons capacity which—in operation—can be fitted with a piercing punch. A knockout ram, used primarily for removal of the finished forging from the die, has a capacity of 750 tons. The press is equipped to receive a set of dies that are mounted on 10-foot square bolsters in the vertical press opening. Working dimensions of the opening are 12 feet maximum and 7 feet minimum in a vertical direction, and 15 1/2 feet in a horizontal direction.

Actually, this design comprises a press built on a press. It allows full usage of the 11,000 tons available pressure on the down-acting ram and the additional ability to intrude a vertical pierc-

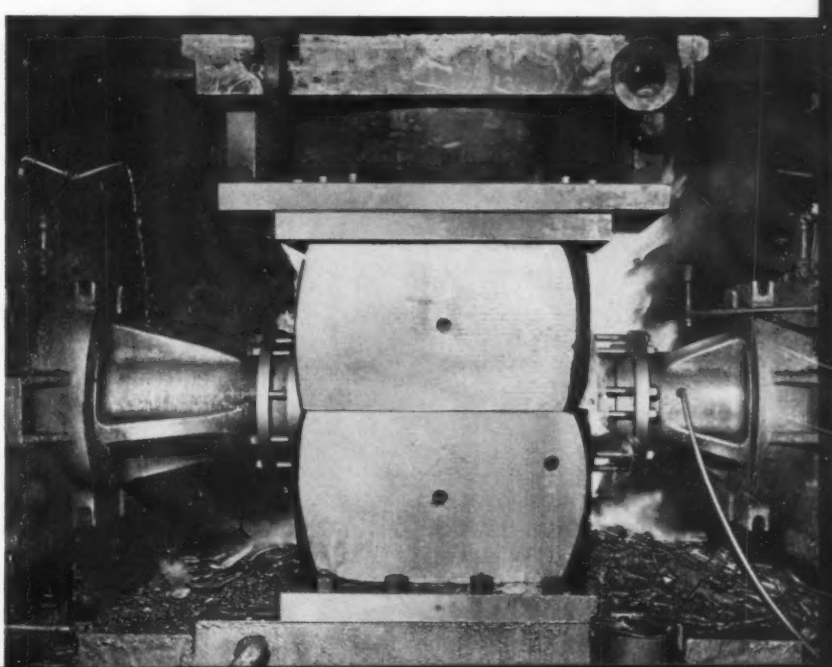


Fig. 4. The vertical ram closes upper half of the split die on the forging slug. Both side rams also close, forcing piercing punches into the work.

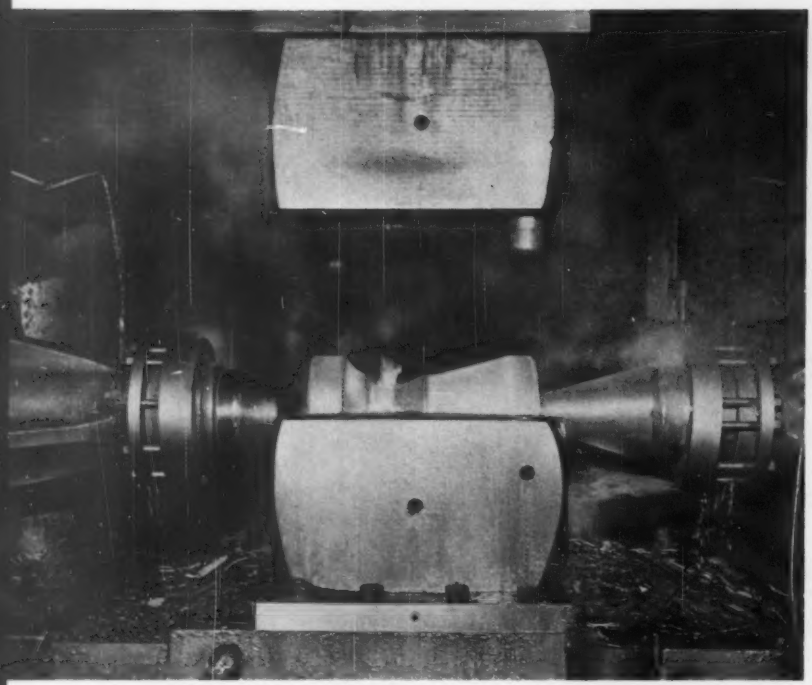


Fig. 5. All three rams have been withdrawn from the work. A knockout ram with a capacity of 750 tons then passes up through the lower die member to break the forging loose.

ing punch with 3000 tons available pressure on the same axis at the same time. The 6000 tons available pressure of each of the two side rams may be used to hold together vertically split dies that have been machined to the desired outside contour of the forging. They may also be used to accommodate piercing punches. In this case, the punches pass into the designed openings in horizontally split dies that are held in place by the down-acting ram.

The piercing punches distribute the hot forging slug into the contours of the split die and, at the same time, provide a forged bore in accordance with the product design. When the punches have gone "home" as planned, the system is essentially closed. Slight excess metal in the slug can be accommodated by providing flash guttering in the die.

Desired grain flow in the metal of the forging and product design are the two determinants in the choice between vertically or horizontally split dies. With either method, the forging can be removed regardless of back draft. The piercing punch or punches are first withdrawn, then the

Fig. 6. After being removed from the split die, the forging is brought to this press where the metal remaining in the throat of the nozzle is punched out.

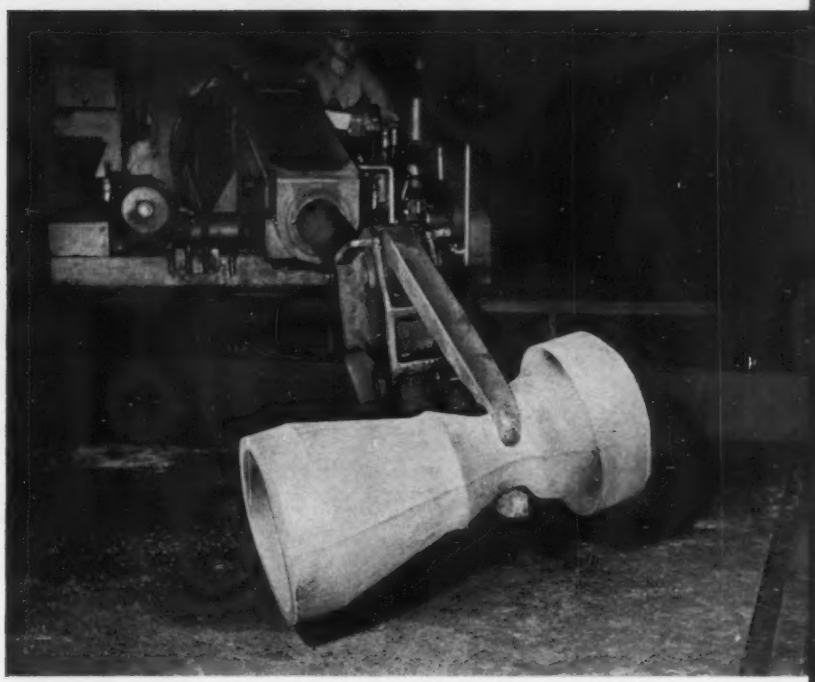


Fig. 7. Specially designed mechanical manipulator removes the forging from the press shown in Fig. 6 and transfers it for heat-treating, cleaning, and finishing operations.

dies are opened. If the dies are vertically split, the knockout ram frees the forging from a lower die member mounted on the bed of the press. In the case of horizontally split dies, the face of the knockout ram is an integral part of the lower die contour and the ram operates through a designed opening. This method of forging results in a work-piece configuration of close tolerance, provides coring to design specifications, and yields a predetermined grain flow that is difficult to obtain by other forming means.

Nozzle Slugs are Preformed Then Split-Die Forged

Alloy steel for the "Nike" nozzle is produced from scrap steel in one of the company's 25-ton capacity electric-arc furnaces and is poured into ingot molds. After ingots are bloomed, they are inspected ultrasonically with a Sperry Reflectoscope. The blooms are then sawed into billets which, in turn, are pressed into forging slugs of the desired size.

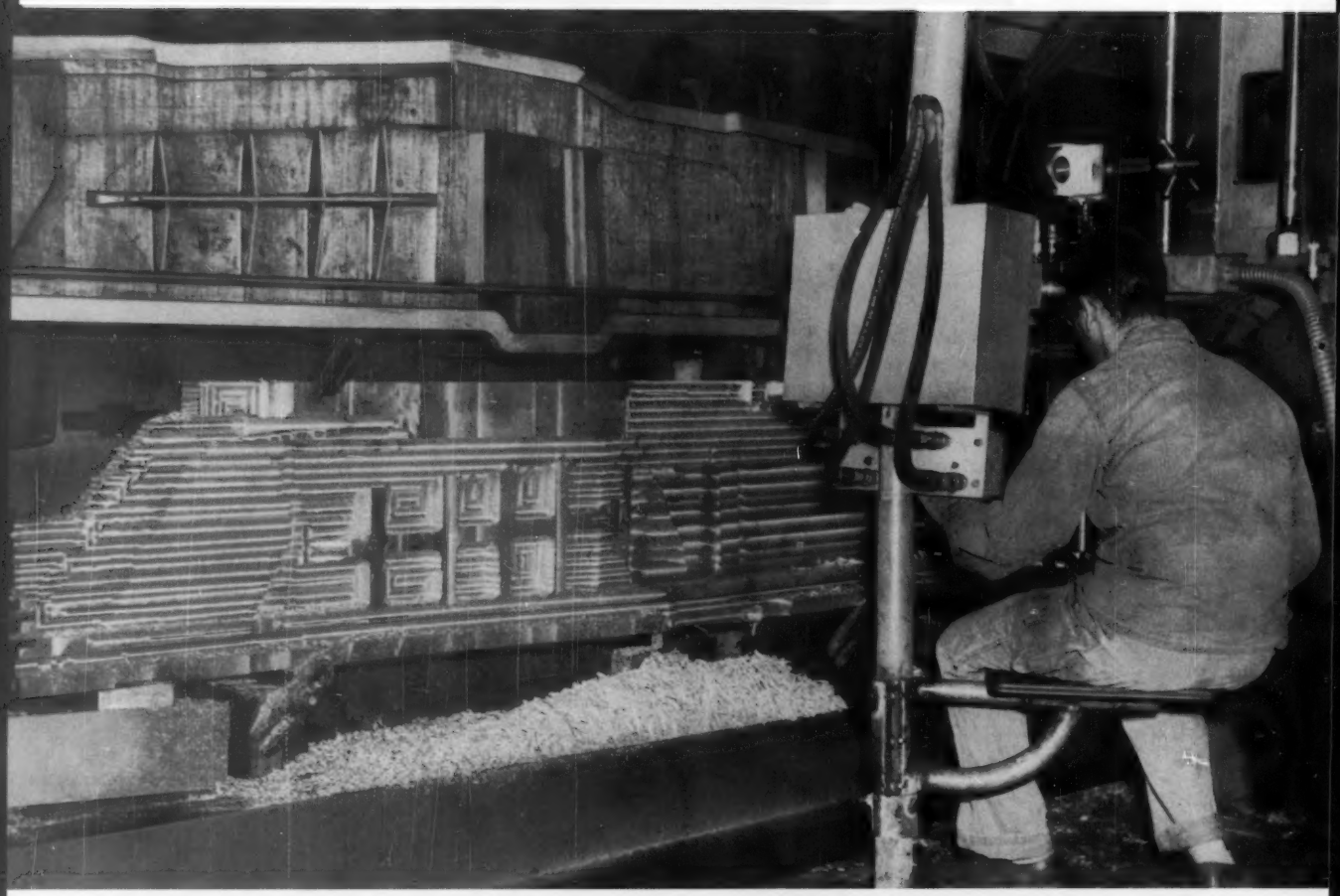
The slugs are loaded into a rotary hearth heating furnace and brought to forging temperature. When the proper temperature has been reached, a mechanical manipulator grips a slug and withdraws it from the furnace. It is descaled, blocked, and then preformed to an hourglass shape on an auxiliary press. The shaped slug can be seen in Fig. 2 as it is supported in the lower die member by the manipulator.

From this auxiliary press, the preformed slug is quickly delivered to the large multiple-ram press and placed in the lower half of a horizontally split die, Fig. 3. At this point, the press goes into action. The vertical ram closes the upper half of the split die on the preformed forging slug, displacing the metal and partially forming the final external shape. Both side rams then converge on the die, Fig. 4, forcing two piercing punches into the work. The punches are tapered to the bore contour of the forward and aft flared sections of the nozzle.

As the punches pierce the slug, the metal is extruded between the surface of the punch and the die cavity. The periphery of the nozzle conforms to the surface of the die cavity, and the nozzle bore, to the surface of the punches.

After all the rams have been retracted, Fig. 5, the forging is loosened from the lower half of the split die by the knockout ram, which acts through the bed of the press and passes up through the die member. The forged piece is plucked from the die and quickly transferred to a 2000-ton trimming press. Here, the metal remaining in the throat of the nozzle is punched out, as can be seen in Fig. 6.

The forged nozzle is then picked up between the fingers of the mechanical manipulator shown in Fig. 7 and transferred to the furnaces where it is given a normalizing heat-treatment. Following heat-treatment, the part is cleaned and the flash is ground off. Thus, a heavy, intricately shaped steel nozzle forging is made in one homogeneous piece ready for simple and economical machining.



MANY of the structural components that help to form the frames of present-day high-speed aircraft are being produced adeptly by a number of small shops located throughout the country. Some of these shops find themselves confronted with jobs that are not only unusual but frequently complex in nature. This situation prompts the use of many interesting machining procedures and, often, the rebuilding of conventionally designed machine tools to perform operations other than those for which they were originally intended.

One company that is engaged in this type of manufacturing is General Engineering Inc. of Baltimore, Md. In their shops are being produced two complicated members. One of these members forms part of the structure and lower inboard wing surface of a new experimental attack fighter-bomber. The second member forms part of the internal wing structure for the B-57 Martin light bomber. This plane, powered by two Wright J-65 jet engines, is currently being delivered to the Tactical Air Command of the United States Air Force.

The lower inboard spar cap, shown being tracer-milled in the heading illustration, is the first of the two components referred to. Much machining is necessary since the part, which weighs approximately 80 pounds when completed, is hogged out of a 1485-pound billet of 7075 (75S) aluminum. The rolled billet has the grain running lengthwise through it. Before any work is done, twelve samples are cut from each part. The samples are labeled to associate them with the billet and then tested for ductility, uniformity of grain structure, and tensile strength.

Contour-machining is preceded by a rough slab-milling operation in which much of the excess metal is removed from the billet. An inserted-tooth cutter, mounted on an Ingersoll spar-milling machine having a 38-foot long table, is used to take roughing cuts along the four longitudinal faces of the work. The purpose of this operation is not only to trim the billet, but also to form the rough dog-leg shape of the spar cap. Several blocks are machined along the edges of the work to serve as tooling and clamping points in subsequent operations.

Following slab-milling, the billet is clamped in place on the 12-foot long table of a Cincinnati hydraulic planer that has been converted to perform three-dimensional tracer-controlled milling. A company-built vertical milling head is installed on the machine but can be replaced with the original planer head if necessary. Although this machine is equipped with three-dimensional

SUBCONTRACT SHOPS PRODUCE COMPLEX AIRFRAME COMPONENTS

Airframe components, especially the highly stressed members that form the basic wing structure, are being either machined from the solid or finished from forgings in increasing numbers. Lighter weight, increased strength, and lower man-hour requirements for fabricating the airfoil sub-assemblies are among the chief advantages of this manufacturing method. Specialized shops operating in a subcontracting capacity are handling a noticeable share of this out-of-the-ordinary machining work.

By RAYMOND H. SPIOTTA
Associate Editor

tracer controls, only a two-dimensional operation is required for rough-contouring the skin side, or bottom contour line, of the spar cap. The contour master model is mounted beneath the tracing stylus, on the table of the hydraulic planer, alongside the work-piece.

Contour-machining the opposite face of the billet is done on a tracer-controlled, three-dimensional machine that has been converted from a Simmons horizontal boring mill. The table of this machine is stationary and the tool-head is fed along two flat rails under hydraulic power. A seat is provided on the moving platform to accommodate the operator.

The work-piece is clamped against a vertical mounting plate on the horizontal machine table. Clamps are placed over the tooling blocks that were left during the slab-milling operation. Immediately above the work is a template, as can be seen in both the heading illustration and Fig. 1. The template has been machined from a built-up block of mahogany.

A single-dimension hydraulic tracer valve and stylus in order to control both the vertical and plate so as to control the quill movement. A second template, made of steel, is located above the first, Fig. 2. This second template is traced by means of a two-dimensional tracer valve and stylus in order to control both the vertical and the horizontal movement of the cutting head. Thus, the two templates and the two styluses combine to give the part its complete three-dimensional configuration. All contouring cuts taken at this time are rough—about 1/4 inch being left for finish machining.

Heat-treating of the rough-shaped spar cap is done outside the plant. The part is brought to a W condition by solution heat-treating. As a result of the treatment, an undesirable amount of warping is encountered. Before the subsequent contouring operations are begun, the part undergoes a limited straightening operation while still in the W condition. Remaining warp is compensated for when the work-piece is mounted on the machine table.

The steps involved in final machining merely duplicate, to a great extent, those of rough machining. First, the spar cap is set up on the Cincinnati hydraulic planer-mill. The skin side (bottom contour line) of the work-piece is then finish-contoured, as can be seen in Fig. 3.

Second, the work-piece is again clamped in place on the vertical mounting plate of the Simmons three-dimensional horizontal boring mill. This time, however, it is finished to size, including the perimeter, as can be seen by referring

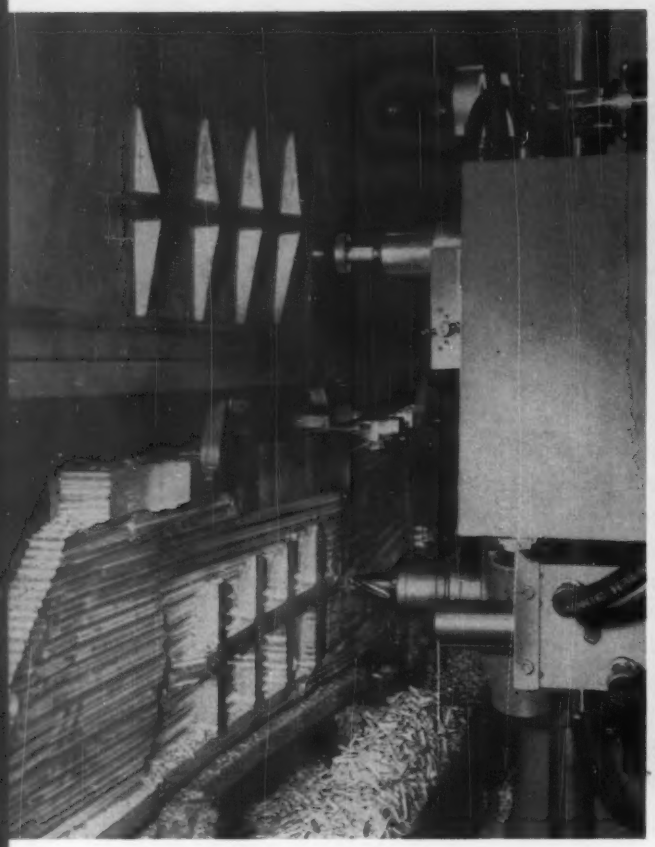


Fig. 1. Contouring a spar cap on a three-dimensional horizontal boring mill. A mahogany template and one of two tracer styluses can be seen directly above the work-piece.

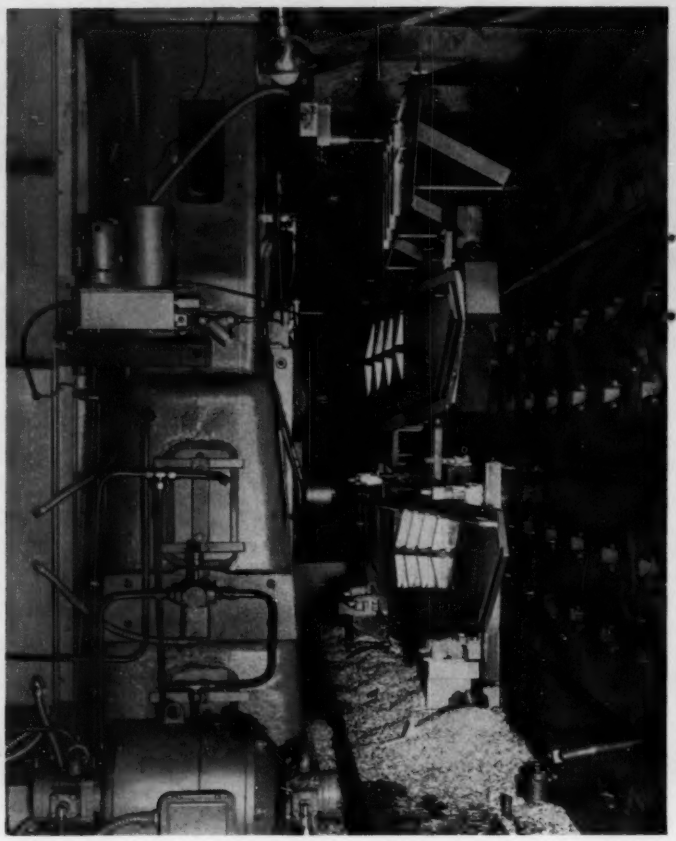


Fig. 2. A small template mounted above the main template contains the pattern of the stiffening-rib area. A second stylus follows this form to direct the rib profiling.

back to Fig. 2. The same two-template system that was used during rough machining is followed. Upon removal from the machine, the spar cap undergoes another straightening operation. This second straightening is accomplished by means of selective shot-blasting of the part in a large booth containing Pangborn equipment. All scratches, nicks, and cutter marks are then removed by hand-finishing methods.

Final inspection of the part proved difficult due to its changing contour and thickness. A tolerance of plus or minus 0.010 inch was maintained on the thickness dimensions and was checked at 190 points along the work surface, as shown in Fig. 4. Two men require three and one-half days to completely inspect each piece.

The second structural wing member previously referred to is the main-wing spar beam shown in Fig. 5. When completed, it is approximately 18 feet long and 1 5/8 inches thick. Tapered longitudinally, it is approximately 18 inches wide at the large end and 8 inches wide at opposite end.

As was the case with the spar cap, the main spar is hogged out of a billet. Weighing 850 pounds before machining, the 2024-T6 (24S-T6) aluminum billet is reduced to only 35 pounds.

Prior to milling, one long edge of the billet is band-sawed to the rough shape of the part. Samples are also cut off and tested for ductility, uniformity of grain structure, and tensile strength.

Upon receipt of a satisfactory test report, the billet is clamped to the vertical mounting plate of a Simmons three-dimensional horizontal boring mill. An aluminum model of the part is used as a template. As shown in Fig. 6, the spar is machined in two halves due to its length. The boring mill must be set up again for milling the second half of the part.

The billet is first hogged out with a 2 1/2-inch diameter, two-lip end-mill of high-speed steel. A speed of 1200 R.P.M. is used. The diameter of the stylus is 0.010 inch larger than that of the cutter to allow for valve travel in the hydraulic control circuit.

A 1-inch diameter end-mill and a 1-inch diameter stylus replace the 2 1/2-inch diameter cutter

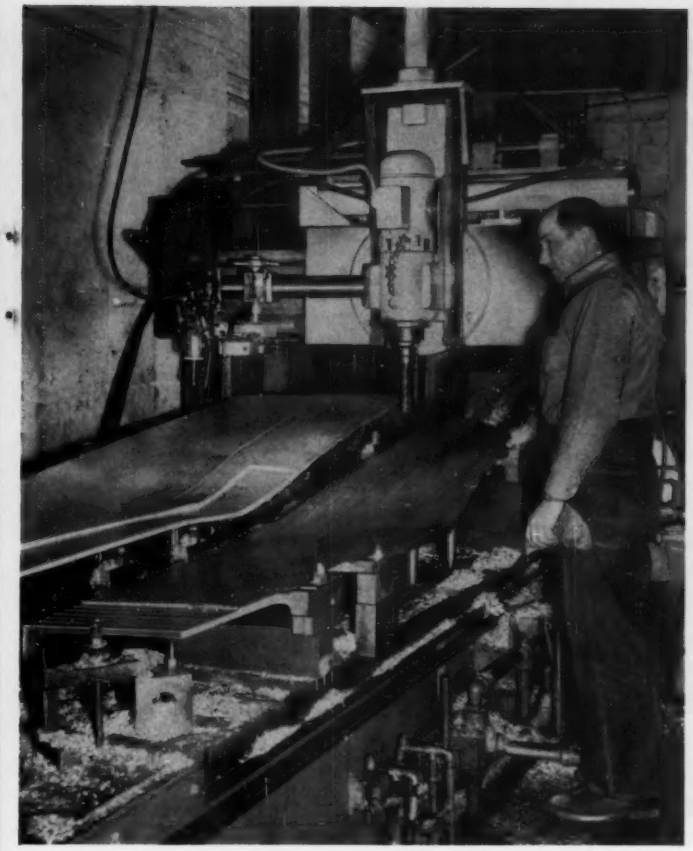


Fig. 3. Finish-contouring skin side of the spar cap on a machine equipped with three-dimensional tracer controls. The plastic template can be seen at the left.

Fig. 4. One of several setups used for checking a completed spar cap. A tolerance of plus or minus 0.010 inch is held on the thickness dimensions and is checked at 190 points.

Fig. 5. Main-wing spar beam for the B-57 Martin light bomber is hogged out of an 850-pound aluminum billet. When completed, the 18-foot long part weighs only 35 pounds. All pockets in the spar are contour-milled.

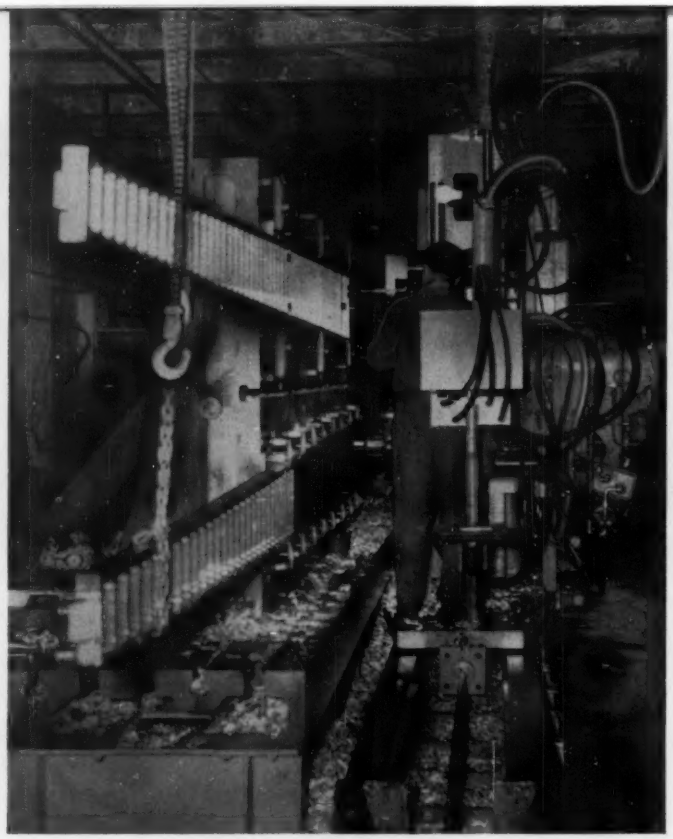


Fig. 6. (Right) Because of the length of the spar it must be tracer-machined in two settings. A rough-milling cut is just beginning on the second half of the work-piece (bottom), the cutter being guided by the template (top).

Fig. 7. (Below) Three 6-inch wide cutters are mounted on the arbor of this horizontal spar-milling machine to accommodate the entire width of the spar. The back face of the 18-foot long aluminum member is shown being slab-milled.

and stylus, and a second group of roughing cuts is taken. These cuts bring the part to within 1/4 inch of its finished dimensions.

After rough machining, the work-piece is transferred to the table of an Ingersoll horizontal spar-milling machine and placed with its pocket side down, Fig. 7. Clamps are placed around the edge of the part and are positioned at an angle to the edge surface. In this way, tightening the hold-down nuts evenly around the work will result in a vise-like grip along the edges of the part and will leave the exposed face (to be machined) free of obstructions.

Three 6-inch diameter cutters are mounted together in the machine arbor. Each cutter is 6 inches wide, making a total of 18 inches, thus allowing the entire width of the back spar face to be milled in one pass. Four carbide inserts are locked in each cutter body, which is rotated at a speed of 700 R.P.M.

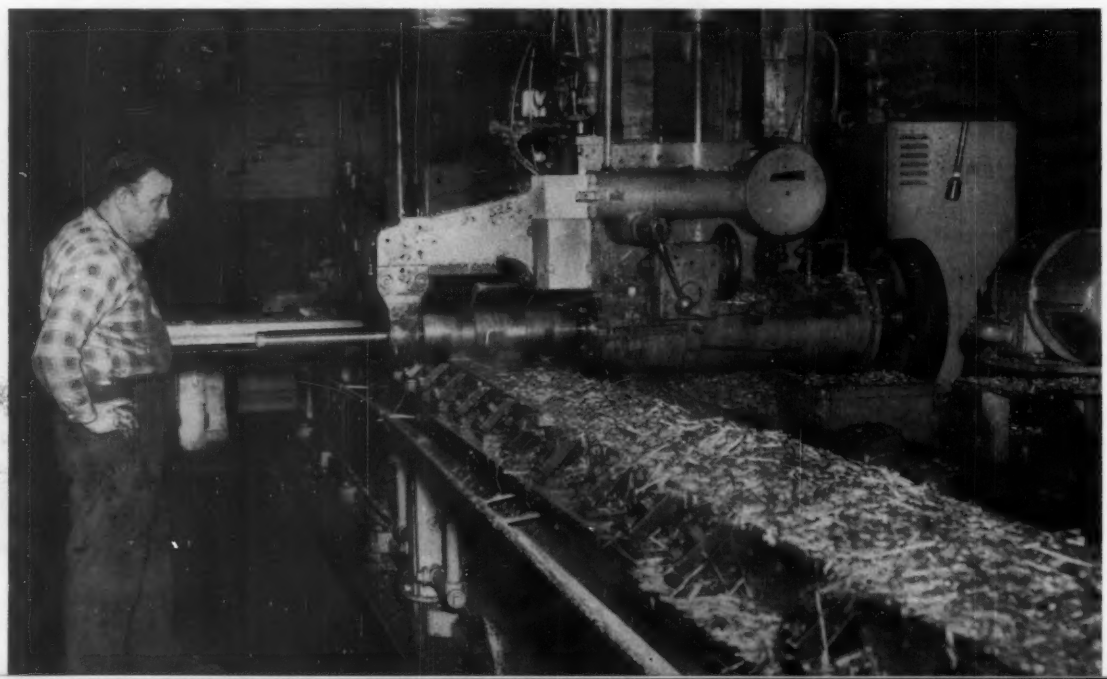


Fig. 8. A spar is held on a vacuum chuck and secured by clamps while the pockets are finish-machined on a tracer-controlled planer-mill. Due to its length, only half the part is milled in each of two setups.

With the back face completed, the next step is to finish machine the pocketed side of the spar. For this step, the part is set up on a Cincinnati hydraulic planer that has been converted to handle three-dimensional tracer-controlled milling, Fig. 8.

A double holding system is used. The back face of the spar is first placed on a vacuum chuck to provide rigid support for the comparatively thin rear wall. Closely spaced clamps are then employed to exert final pressure on the part.

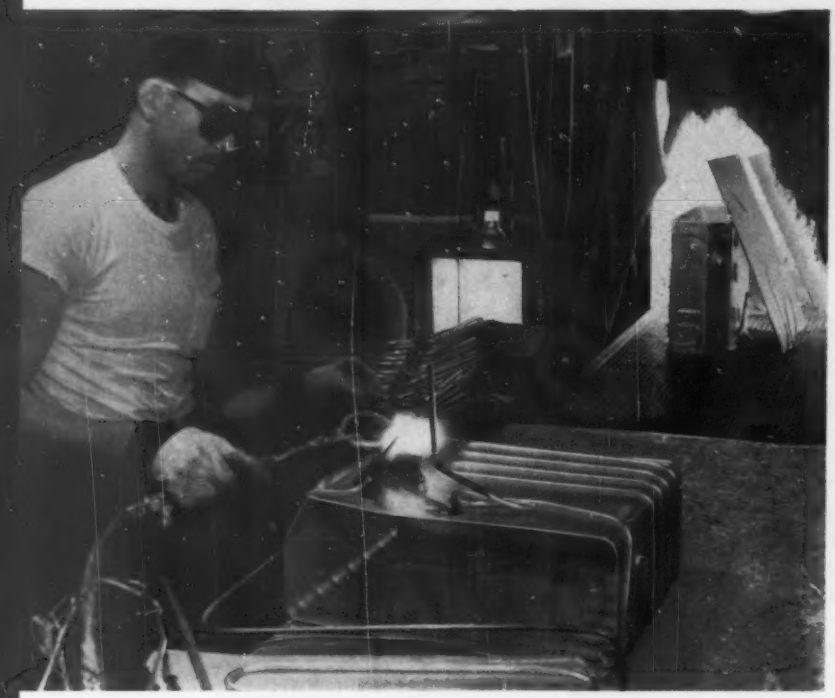
As can be seen in the illustration, the row of clamps extends only half-way back along the spar. The part is longer than the working distance of the machine, therefore it is handled in two settings, as during rough-contouring, with only half being milled in each setup. Two templates are also used, one for each half of the spar.

For the finishing cut a 1-inch diameter end-mill is used, as shown in Fig. 9. All the pockets are machined to size with this cutter. Much care is exercised with regard to the amount the tool is fed down into the bottom of the pockets as the rear wall thickness is only 0.064 inch.

A 1/2-inch diameter ball end-mill is then substituted for the first cutter, and 1/4-inch corner radii are formed in the pockets. Following this, the clamps are removed and the spar is held in place by the vacuum chuck and a "strongback," or reinforcing rib, down the center of the part. The ball cutter is removed, and a 1 1/4-inch diameter end-mill is inserted. With the stylus still contacting the template, the upper edges of the spar and pocket walls are milled to size. The final machining operation on this half of the spar consists of cutting a sealant groove around the outer edges of the part. After reversing the position of the work, the same series of cuts is taken on the second half. Hand-finishing is employed to eliminate all surface defects and cutter marks.

Fig. 9. Finish machining the pocket side of a main spar with a 1-inch diameter end-mill. Following this, a ball end-mill is used to form the rounded corners in the pockets. The template and stylus can be seen in the upper left-hand corner.

Six Steps to Good Silver Brazing



Obtaining strong, non-porous joints by silver-brazing methods need not be a problem. By bearing in mind only a few important points—part clearance, joint cleanliness, flux application, work-piece support, heating technique, and flux removal—sound brazed joints can be a consistent result.

By A. W. SWIFT, Service Engineer
Handy & Harman, New York City

SIX basic steps have become almost ritual in good silver brazing—clearance between parts, cleanliness of joint area, application of flux, support of work, manner of heating, and removal of residual flux. These procedures may appear to require extra effort, but, in the long run, they save both time and money. They make it possible to realize the inherent versatility and economy of low-temperature brazing by producing strong, leak-tight joints of consistent quality. Although compiled primarily for hand torch heating, most of the steps apply to all silver brazing, regardless of heating method employed.

Proper Clearance Between Parts Determines Joint Strength

Strongest possible joints will be obtained when the clearance between parts (at brazing temperature in the case of dissimilar metals) is between 0.0015 and 0.004 inch. Too little clearance limits the amount of alloy that can flow into the joint, thus producing a weak bond and sometimes causing voids. Too much clearance may cause uneven distribution of the alloy, as well as voids, by reducing the capillary attraction between the joint faces and the molten alloy. It also will waste the filler metal. The graph in Fig. 1 illustrates the effect of clearance on joint strength.

Clean Joint Surfaces Are a Must

All surfaces to be joined must be free of dirt, oxides, grease, and oil. Although flux can dissolve a thin film of oil, such as may be present on mill-supplied materials, it is not designed to do heavy cleaning. Oxides and dirt can be removed by cleaning with emery cloth or steel wool, or by filing or grinding. For large production quantities, blast cleaning or pickling in batches may be more economical than hand work.

Grease and oil can be removed with a suitable solvent or in degreasing equipment. Parts should be cleaned reasonably close to the time of brazing and, once cleaned, should be handled carefully to avoid contamination.

Flux Should be Carefully Applied

Except for a few instances when a self-fluxing silver-phosphorous brazing alloy is employed for joining copper parts, the use of flux is essential. It does three jobs: protects the metal from oxidation during heating; dissolves any oxides that may

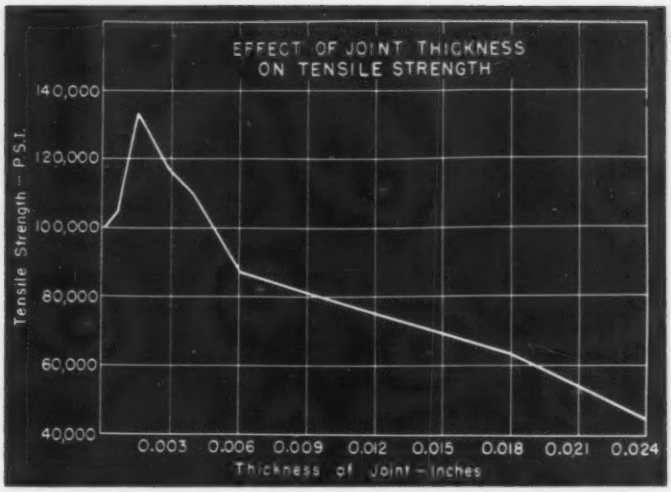


Fig. 1. The relationship between joint thickness (clearance) and joint strength is graphically illustrated. Actual strengths will vary somewhat with type of metal being brazed, but the effect of clearance is relatively the same for all metals.

form; and helps the brazing alloy flow quickly and wet the joint metals completely. Enough flux should be applied to obscure the underlying metal, ascertaining that no gaps are left in the coating. The silver-brazing alloy should be fluxed also.

If the flux refuses to wet some areas of the metal, as shown at the left in Fig. 2, it is an indication that the surface has not been cleaned properly. A well-prepared surface will take flux, as shown at the right. Flux will brush on more quickly, spread more uniformly, and produce a better action if it is kept warm—between 90 and 100 degrees F.—and covered. Several types of heated flux pots are commercially available. When torch heating, flux should be applied just before the parts are brazed so that it will not dry out and flake off, leaving the metal unprotected.

Supporting Fixtures Prevent Misalignment During Heating

The components to be joined should be supported to prevent them from shifting or becoming misaligned during heating. If clamps are used, one end of the assembly should be free to expand. If not, the work may distort or buckle during heating. The fixture should touch the parts at as few points as possible (and these points should be out of the brazing zone) to avoid conducting heat away from the joint area.

Simple fixtures are preferable. Many assemblies, such as those containing tube and socket joints, are self-aligning and require a minimum of support. In other cases, a rod pressing down on the upper end of the assembly will hold the parts in place. It is desirable to have a slight pressure pushing the parts together, particularly when the brazing alloy is preplaced, so that any excess alloy and flux will be forced out of the joint when they become molten. This will cause the parts to seat more firmly and will help produce a stronger joint.

Heating Techniques Affect the Flow of Alloy

To minimize oxide formation during heating, the torch should be adjusted to produce a neutral, or reducing, flame as shown in Fig. 3. The tip of the flame should be somewhat bushy rather than sharp and needle-like. By applying the flame to the area around the joint rather than to the joint itself, the heat will soak into the brazing area more uniformly. The torch should be kept moving—a stationary flame will exhaust the flux, cause excessive oxidation, and may distort thin-gage parts.

If the parts being brazed are of unequal gage,

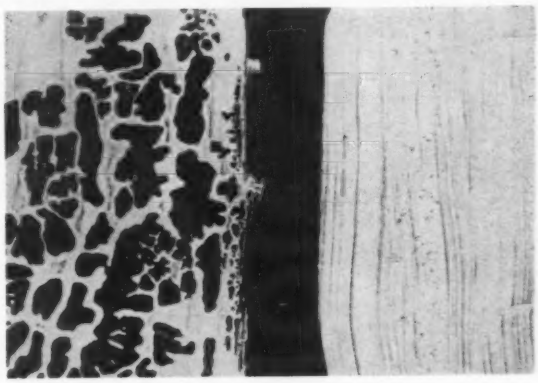


Fig. 2. A solid, uniform coating of flux (right) is important in obtaining a sound brazed joint. Voids in the flux coating (left) usually indicate improper cleaning.

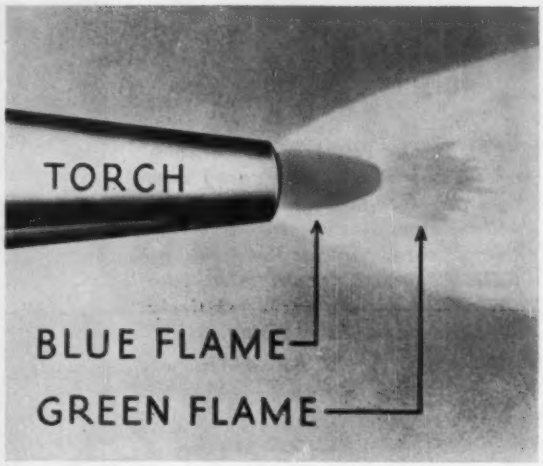


Fig. 3. A neutral, or reducing, flame is preferred because it prolongs the activity of the flux. The green "feather" seen at the tip of the inner cone indicates a slightly reducing flame.

the heavier section will need more heat in order to reach brazing temperature at the same time as the thinner member. When dissimilar metals are being brazed, the more conductive metal should receive more heat to make up for the greater amount of heat it transmits from the joint area.

The parts should be heated to brazing temperature as rapidly as possible, with due caution to avoid overheating, so that exposure to the flame, and hence the possibility of oxidation, is held to a minimum. If the brazing alloy is preplaced it is not advisable to melt it by direct application of the torch flame, but rather to let the heat soaked up from the joint area do the job. In the case of hand feeding, the joint should be brought to brazing temperature before the alloy is entered.

The appearance of the flux can be used as a guide to the temperature of the joint. As the flux is heated, it gradually loses its white opaque color. At a temperature of about 1100 degrees F.—which is slightly below the flow temperature of some commonly used silver-brazing alloys— the flux appears to be a colorless, transparent, and somewhat glossy material resembling cellophane. The silver alloy should be applied a second or two later. The temperature of the joint can be tested directly by touching the end of the brazing alloy wire to the joint and melting a small piece of it in the torch flame. If the alloy draws up into a ball or forms a sluggish puddle, the metal has not yet reached brazing temperature.

When the parts are up to temperature, a section of alloy can be laid in the seam and it will melt and flow quickly into the joint like a thin liquid. If the brazing alloy does not distribute itself evenly, the part of the joint deficient in alloy probably is not quite hot enough. In this case, no more alloy should be applied but the torch flame moved with a brushing motion toward the empty section of the joint. If enough alloy is present, it will follow the heat and complete the joint even though it is being worked against gravity.

Single-tip torches of multiple-port design are popular for brazing relatively straight or moderately curved joints. However, for brazing joints on small-diameter tubing, 1/2 inch or less, double-tip torches are helpful in producing quick and uniform heating since the joint can be heated from two sides simultaneously. In the heading illustration can be seen a double-tip torch being used to braze tubing on a refrigerator evaporator.

Flux Should be Removed Promptly

Flux can be removed most easily right after the joint is brazed—while it is still hot. Wiping the joint with a wet rag or quenching it from a black

Fig. 4. Quenching the parts from a black heat speeds flux removal. Cooled flux can be removed more easily in a hot, agitated bath containing about 10 per cent sulphuric acid.

heat will flake off most of the adhering flux. If the flux has cooled somewhat, agitated hot water should be used. Cleaning with a stiff brush may be necessary in addition to soaking if the flux has cooled completely. Stubborn pockets of flux containing soluble oxides can be removed in a warm pickling bath of 10 per cent sulphuric acid, Fig. 4. Nitric acid should not be used because it may attack the brazing alloy. In practically all instances, flux can be removed during normal pickling procedures preparatory to plating or other finishing operations.

Cleveland Scene of Metal Show

THE National Metal Exposition and Congress, to be held in Cleveland, Ohio, from October 8 through 12, is expected to be the largest in the thirty-eight-year history of the Show. More than 470 companies are on the exhibitor roster. Their displays will fill the 250,000 square feet of floor space available in the city's Public Auditorium and Exhibition Halls. Sponsors of the Metal Show are the American Society for Metals, which will be quartered at the Hotel Statler; the American Welding Society, located at the Hotel Cleveland; the Metals Division of the American Institute of Mining, Metallurgical, and Petroleum Engineers, headquartered at the Hotel Carter; and the Society for Non-Destructive Testing, rallying at the Hotel Hollenden.

Among the many technical papers of interest to the metalworking field that are to be presented by the American Welding Society are "Shielding Gases for Inert-Gas Welding," by W. H. Helmbrecht and G. W. Oyler, The Linde Air Products Company; "Problems Involved in Spot-Welding Titanium to Other Metals," by F. W. McBee, Jr. and J. H. Henson, Defense Research Laboratory, and L. D. Benson, University of Texas; "Silver Brazing Lap Joints in Stainless-Steel Tubing," by G. H. Bohn, The Linde Air Products Company; "Selection of Proper Inert-Gas Shielded Arc-Welding Process," by C. J. Sullivan and I. D. Holster, Jr., Air Reduction Sales Co.; "Design Requirements for Fusion Welding Titanium in Aircraft Applications," by R. Meredith, North American Aviation; and "Fundamental Concepts of Oxygen Cutting," by R. L. Stoecker and H. B. Moen, Air Reduction Co., Inc.

Papers of interest to be presented before the American Society for Metals will include "The Influence of Alloying on the Elastic Modulus of Titanium Alloys," by W. H. Graft, D. W. Levinson, and W. Rostoker, supervisor, Physical Metallurgy Research, Armour Research Foundation; "Bend: Tensile Relationships for Tool Steels at High Strength Levels," by J. C. Hamaker, Jr., manager, V. G. Strang, research metallurgists, and G. A. Roberts, vice-president, technology, Vanadium-Alloys Steel Co.; and "Aging Reactions in Certain Super Alloys," by W. C. Hagel and H. J. Beattie, Jr., Materials and Process Laboratory, General Electric Co. The Society is cooperating with the General Motors Research Center in the presentation of a special lecture series covering the factors affecting the fatigue endurance of carburized steel. One of the lectures in the series, entitled "Residual Stresses in Carburized Steels," will be presented by W. S. Coleman, staff member in the Metallurgy Section of the General Motors Research Center.

On the afternoon of October 8, the Metals Division of the American Institute of Mining, Metallurgical, and Petroleum Engineers will feature a symposium on nuclear metallurgy. Included in the talks will be "Theory and Mechanism of Radition Effects," by Dr. George Vineyard, Brookhaven National Laboratory; "Irradiation Effects in Physical Metallurgical Reactions," by Dr. Donald Thomas, Westinghouse Atomic Power Division; and "Irradiation Effects on Reactor Materials, " by Dr. Douglas Billington, Oak Ridge National Laboratory. The Society for Non-Destructive Testing will review the latest advances in its field by presenting such technical papers as "Developments in Non-Destructive Testing," "Non-Destructive Testing of Ordnance," and "Non-Destructive Testing of Aircraft."

Among the technical sessions having more than ordinary scientific significance will be a one-day conference on the theme "The Scope of the Metal Thorium," jointly sponsored by the Atomic Energy Commission and the American Society for Metals. It will be chaired by four leading scientists: Drs. F. H. Spedding and H. A. Wilhelm, director and associate director, respectively, of the Institute for Atomic Research, Ames Laboratory, Ames, Iowa; and E. Epremian, chief, Metallurgy and Materials Branch, Division of Research, and R. Carson Dalzell, assistant director, Engineering Development Branch, both of the United States Atomic Energy Commission, Washington, D. C. Twenty-two talks by top atomic-nuclear experts are scheduled to be presented.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Lubricant	**Acrawax C Atomized**	A finely powdered synthetic wax lubricant which is non-tacky and non-corrosive. It is insoluble in water, oil, and solvents and is also a good dielectric.	Used to lubricate very tight-fitting parts such as screws threaded in metal.
Brazing Alloys and Flux	**Aircosil Alloys Aircosil Flux**	Penetrating action of these materials is fast, resulting in the formation of a small, neat fillet left outside the joint. Bonds are liquid- and gas-tight under pressures and are strong and ductile, withstanding shock, vibration, and wide temperature changes.	The alloys are available in various forms such as rod, wire, sheet, rings and gaskets, and together with the flux can be used to join ferrous, non-ferrous, and dissimilar metals.
Metal-containing Resin	**Airtemp Plasti-Metal 707**	A two-component, epoxy-base resin which can be sawed, drilled, tapped, polished, and machined and can be shaped into complex parts using both casting and laminating techniques.	Used to make jigs and fixtures, masters and models, foundry items, and plastic forming dies and molds.
Silver Solder Alloys	**All-State No. 105 Medium-Temperature Solder All-State No. 107 General-Purpose Silver Solder**	The melt and flow points are in the medium-temperature range—between soft solders and low-temperature brazing alloys. Shear strengths of 18,000 and 20,000 pounds per square inch are obtainable from these alloys.	Recommended for lap, sleeve, and socket type joints. Each alloy requires a special flux, and its residue should be washed off.
Rust Preventative	**Aluminum Serviron**	An aluminum coating that is applied to dark surfaces which are damp, wet, or sweating. The coating formed is non-toxic and corrosion-resistant.	Used to coat water tanks, underground pipelines, and hulls of ships.
Stainless Steel	**AM350**	This steel is soft and ductile and readily fabricated in the initial condition. It is then hardenable by heat-treatment at a temperature low enough to prevent excessive scaling or distortion in the hardened condition. It exhibits high impact strength at low temperatures as well as good corrosion resistance.	Applications other than those in the aircraft industry include such items as flat and coiled springs, corrosion-resistant fasteners, dental and surgical equipment, saws and saw blades, piston rings, glass molds, pump parts, camera parts, and cutlery.
Cleaning Material	**Anti-Rust Cleaner CP**	A soluble emulsifiable oil type cleaner containing additives for the removal of organic soil. This cleaner forms a stable emulsion with hot or cold water over a wide range of dilutions and with any water hardness condition.	For removal of organic soils such as cutting fluids, shop soils, drawing compounds, and greases. Used as a power wash and an anti-rust spray. Can also be used as a coolant.
Welding Flux and Wire	**Arcosite Flux and Chromar**	The particle size of the flux assures uniformity of arc action, alloy recovery, bead penetration and shape, and easy flow through flux-feeding devices. The wire is available in many compositions.	The flux is suitable for welding austenitic, ferritic, and martensitic stainless steels. The wire may be used with many welding methods.

For names and addresses of manufacturers of products listed, see end of this section

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Grinding Aid	Armor-Kut (R)	A heavy red liquid having the consistency of honey and used most conveniently at temperatures in the neighborhood of 120 degrees F. It is introduced to the surface of a grinding belt as a liquid stream.	Use of this material prolongs the cutting life of abrasive belts and provides a good surface finish on the metal being ground. Can be used for finishing titanium.
Asbestos Fabric	ATR Series Woven	A series of friction materials of woven asbestos fiber impregnated with various oils and resins. Contains no metallic particles or wires. Is light. Available in ring, band, or core forms.	Uses include oil-cooled power transmission equipment such as clutches, torque convertors, power take-offs, steering clutches, and brakes.
Die-casting Alloys	Aur-O-Met 56 Aur-O-Met 57	These nickel-aluminum die-casting bronzes provide strength, corrosion resistance, and ease of machinability. Both have a tensile strength of 120,000 pounds per square inch.	Use of these alloys in die-casting has resulted in the discontinuance of the use of steel forgings with bronze overlays and parts machined from solid bronze.
Floor Armor	Baby Hexteel Surface Armor	A lightweight hexagonal type floor armor which is usually filled with a hot or cold mastic.	For resurfacing ramps, factory aisles, runways, loading docks, and other surfaces where rough usage prevails.
Penetrating Oil	Bear Penetrating Oil	A fast-acting penetrating oil having properties of lubrication and rust prevention and a high flash point.	Loosens rusted and frozen metal parts such as bolts, bushings, pipes, and battery connectors.
Strip Material	Beryllium-Copper Strip	A beryllium-copper strip rolled to a thickness of 0.001 inch with a tolerance of plus or minus 0.0001 inch.	Used as a pressure-sensitive diaphragm in ice-detection control systems in aircraft.
Stainless-steel Wire	Blue Label Stainless-Steel Wire, Type 302	This wire is corrosion-resistant, has good coiling properties, and can be bent sharply.	Designed primarily for use in the production of springs, it is also suitable for other types of wire forms.
Thermoplastic Sheet	"Bondized" Califilm "Bondized" Kelon-F	These specially treated thermoplastic sheet materials can be bonded to a variety of materials using ordinary adhesives. The Califilm is available in thicknesses ranging from 0.005 inch to 0.015 inch, and the Kelon-F in thicknesses ranging from 0.015 inch to 0.250 inch.	For cementing steel, aluminum, wood, etc. in parts that encounter wear or corrosive conditions such as liners and coverings for tanks, jigs, fixtures, rollers, and machine parts.
Structural Adhesives	Bondmaster M615 Bondmaster M616	Bondmaster M615 is intended for normal temperature use and exhibits a shear strength of up to 3500 pounds per square inch. Bondmaster M616 provides shear strengths up to 3000 pounds per square inch at a temperature of 180 degrees F.	For bonding metal-to-metal and metal-to-pl stic. They were originally developed for aircraft structural applications but are now being used more widely.
Epoxy-base Adhesive	Bondmaster M620	This single-component epoxy-base adhesive has a smooth buttery consistency which enables it to be spread on parts being bonded to the proper depth using a brush or spatula. Material does not "drip" or "run" either before or after curing.	Used to bond metal to metal or to rigid plastic.
Nickel-chromium-silicon Alloy	Brinalloy	High wear and corrosion resistance have been exhibited by this alloy. Its tensile strength exceeds 150,000 pounds per square inch.	Used as a seating material for bronze valves.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Metal Cleaner	**Brooks Rollene EC**	Cleaning is accomplished through penetrating action. Cleaner gets under the foreign matter and floats it away. Remaining film is non-corrosive and acts as a lubricant for subsequent drawing operations.	Used in circulating systems for removing foreign substances from metal sheets prior to final processing.
Cemented Carbides	**CA-606** **CA-609**	Steel-cutting carbides developed to give great edge wear without loss of shock resistance. Both contain anti-cratering ingredients.	Grade CA-609 used where cuts are in excess of 1/16 inch. The other grade is useful where close machining tolerances must be maintained.
Stainless Steel	**Carpenter Stainless No. 7-Mo (Type 329)**	Resists nitric and hydrofluoric acids. This stainless steel is claimed to be the first metal to have commercial resistance to an extremely corrosive mixture of these strong acids.	For equipment where nitro-hydrofluoric acids are handled in pickling or similar operations.
Soldering Flux	**C-Flux**	A greaseless and binderless flux used for joining copper tubing. The flux tins the metal as it cleans, permitting solder to flow smoothly with deep penetration.	Use eliminates the necessity of prior cleaning. It is also said to be advantageous because of easy cleaning of residues.
Alloy Steel	**Chromewear**	A steel with great wear and abrasion resistance. Abrasion resistance said to be approximately five times that of air-hardening, high-carbon, high-chromium type steels.	Heat-treatable to a high hardness, it is tough enough for most tooling applications. It should be used where machining and grinding requirements are of a relatively simple nature.
Silicone Rubber	**Class 700**	A silicone rubber that remains flexible at 600 degrees F. for 150 hours or longer. Other properties include: resistance to ozone-aging and weathering, low-temperature flexibility, and a low moisture absorption property.	Suitable for molding, extrusion, or calendering fabrication methods. Uses include: oven door seals and parts for hot materials handling equipment.
Brazing Alloys	**Coast Metals 50**	A series of high-nickel brazing alloys with the same mechanical properties and corrosion and oxidation resistance as the stainless and heat-resistant alloys which they are designed to join. All alloys have good flow and wetting qualities.	Used to braze rocket nozzles to their respective components and also to coat or braze roller parts, honeycomb materials, jet-engine components, and valves.
Silicone Rubbers	**Cohrlastic HT 655** **Cohrlastic HT 666**	These compounds are immune to ozone deterioration, flexible at high and low temperatures, and have non-adhesive surfaces. Tear and tensile strengths are 197 pounds and 1650 pounds per square inch, respectively, at room temperature and are approximately halved at temperatures of 400 degrees F.	Materials are being used in the aircraft industry for making external seals.
Hard-facing Alloy	**Colmonoy No. 2**	A chromium-molybdenum-silicon alloy which can be deposited on manganese and other steels from an AC-DC welding electrode. After a second pass the deposit exhibits a hardness of 55 to 60 Rockwell C.	Applied to the working surfaces of construction, mining, and aggregate handling machinery where impact and wear resistance are required.
Hard-facing Material	**Colmonoy No. 70**	A nickel-chromium-boron-tungsten hard-facing material that provides a wearproof, corrosion-resistant surface to parts exposed to extreme conditions of vibration or heat.	For overcoming fretting and fretting corrosion on jet-engine shafts. Also used on engine valves, chemical valves, acid pump parts, and cold washers.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Core Material	Corfoam 114	A high-strength, lightweight material used for structural core applications. It exhibits a compressive strength of 37 pounds per square inch for a 3-pound-per-cubic-foot density and a compressive strength of 1100 pounds per square inch for a 21-pound-per-cubic-foot density.	Used for making cores for stretch dies, jig dies, check fixtures, and models.
Anti-seize Sealant	'dag' Dispersion No. 217	A graphite product that prevents seizing and provides sealing. It is non-flammable even in the presence of high-pressure oxygen at temperatures of 575 degrees F. and higher.	It has been used as an anti-seize and sealant for high-pressure oxygen systems where line pressures reach 2000 pounds per square inch.
Casting Alloy	DC-50	This hardenable corrosion-resistant alloy, having the same nominal composition as Armco 17-4 PH hardenable stainless-steel alloy, is readily machinable in the solution-annealed condition and when hardened has appreciable ductility and toughness.	Recommended for applications where wearing conditions exist, such as ship propellers and pump impellers; also used as a casting material for structural parts of aircraft and for thrust bearings.
Aluminum Putty	Devcon F	An 80-20 aluminum plastic putty which adheres to aluminum, steel, bronze, brass, and cast iron. When hardened, it can be machined to a feather edge; sand-blasted or treated in a Pangborn or similar machine; or painted and then baked. It will not bubble, shrink, or run at regular baking temperatures.	For filling very large and small holes in aluminum and steel castings, to cover holes which have been drilled incorrectly, and to build up worn sections.
Magnesium Sheet and Extrusions	Dow Magnesium Sheet and Extrusions	Magnesium in the form of rolled plate and in special extruded shapes. Dimensional stability during and after machining has been insured by stress-relieving above 700 degrees F. It is tough and free from porosity.	For making checking fixtures, bases, and gages; assembly and locating jigs, fixtures, and bases; and vibration test fixtures.
Nickel Alloy	Ductile Ni-Resist	A high-nickel alloy cast metal that exhibits ductility as well as corrosion resistance. Tensile strength, 58,000 to 65,000 pounds per square inch; elongation, 8 to 20 per cent.	Used in aircraft and chemical equipment, pumps, and compressors.
Aluminum "Metal" Coating	Duro Aluminum Shell Coating	An anti-rust shell of non-porous aluminum "metal." It will withstand considerable flexing as well as extreme hot and cold temperatures and can be filed.	In addition to protecting structural work, it is useful for coating porous castings, metal signs, and automobile bodies, as well as wood.
Tooling Compound	Epocast	An impact-resistant plastic tooling compound made from a combination of liquid epoxy resin and a polysulphide liquid polymer. Has a durometer hardness of 80 to 95.	Suitable for the production of facings for drop-hammer dies.
Epoxy Resin	Epocast 13	A fluid epoxy resin which, when mixed with appropriate amount of hardener, has a pot life of 8 days. Curing temperatures range from 200 to 250 degrees F.	Used for potting and encapsulation of electrical components and as a filler material for making large mechanical castings.
Aluminum Casting Alloy	F132	Replaces D132 in order to conserve nickel. Tensile strength, 36,000 pounds per square inch; yield strength, 28,000 pounds per square inch; elongation, 1 per cent in 2 inches; and Brinell hardness, 105.	For castings formerly using aluminum alloy D132.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Steel Bar	**Fatigue Proof**	A high-strength free-machining steel bar which requires no heat-treating. Machines fast with no distortion, is uniform in structure, and exhibits good wear resistance.	Used for machining operations where a high-strength steel bar would be required and where heat-treating would not be economical.
Surface Coating	**Ferrox**	A non-skid plastic abrasive composition which resists the action of oil, chemicals, and weather.	Suitable for application to concrete floors, ramps, platforms, and around machine areas.
Molded Packaging	**Fibre Forms**	These paper pulp molds are strong, waterproof, and oil-resistant. Each package is individually designed to hold its contents snugly, thereby eliminating the need for further wrapping or packing materials.	For industrial packaging of such items as appliances, gears, electronic products, etc.
Sintered Carbide	**Firthite TXL**	A sintered carbide with a hardness of 92 Rockwell A, high strength, and good wear and shock resistance.	For steel-milling applications.
Rustproof Coating	**Gard Anti-Rust Spray**	A rustproof coating containing silicones and polar compounds. The film formed is non-creeping and self-healing. It displaces water and neutralizes fingerprints.	Formulated to prevent rust and corrosion in both outdoor and indoor storage of fine equipment.
Plastic Laminate	**G-E Textolite (R) Cold Punch 11570**	This laminate permits close registration punching at normal room temperatures. Material is translucent.	For automatic production of electronic equipment utilizing printed circuits.
Lubricating Process	**Gorlube**	A process that incorporates a solid film lubricant of molybdenum disulphide into the working surfaces of rubber parts to reduce their frictional qualities.	For the treatment of O-rings, valve seats, rubber packings, resilient mounting, and similar parts.
Cemented Carbides	**Grade CA-608 Grade CA-610**	These alloys resist the cratering action of the continuous chip and are provided with great impact resistance. CA-608 is recommended for light machining and finishing. CA-610 is designed for use where breakage is the factor limiting tool life.	For machining steels of high alloy content or other hard materials. CA-610 may be used for cuts that are interrupted, and CA-608 where increased speeds and decreased feeds may be required.
High-titanium Carbide	**Grade 330**	A tough, easy-to-grind carbide with a nickel binder. It is not quite as hard as cobalt binder type carbides but is equally wear-resistant. Has a rupture strength of about 200,000 pounds per square inch and a hardness of 91.5 Rockwell A.	For precision finishing and boring of steels.
Cemented Carbide	**Grade 860**	A milling grade carbide for milling high tensile strength cast irons that range in hardness from 223 to 248 Brinell.	For face-milling, plane-milling, or slotting operations. Performs well where heavy scale and interruptions are encountered.
Aluminum Bar Stock	**Harvey Hollow Bar**	A hollow aluminum bar stock of 6066 analysis which exhibits free machinability, good corrosion resistance, high strength, and good finishing characteristics.	For producing aluminum machine parts. It provides good chip control, which results in less handling and processing.
Resin-impregnated Wood	**Hasko-Preg**	A laminated wood product which exhibits good dimensional stability. It is affected very little by temperature and humidity changes. The material is decay-, acid-, and heat-resistant.	For making die models and patterns, housing for electrical control equipment, and acid-bath tanks.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Drill Blanks	**Hayden Drill Blanks**	These blanks are available in six tolerance ranges other than the regular unground condition.	These blanks are used to make gages, test bars, dowels, etc.
Tungsten Alloy	**Hevimet**	A high-density, high tensile strength alloy of tungsten, nickel, and copper that can be readily machined and ground. Its machining characteristics are similar to those of cast iron.	It is used extensively for radioactive shielding and, because of its weight, as a material for balancing.
Glazing Material	**Homalite CR-39**	A transparent scratch- and abrasion-resistant glazing material which can be easily machined and is virtually unaffected by welding splatter. The material is lightweight and highly resistant to shatter.	It is used for such safety applications as goggles and shields, instrument faces, grinding wheel guards, and windows for viewing dangerous processes.
Cutting Coolants	**Hypercut XX**	A triple-additive-treated, water-soluble cutting coolant. Lessens frictional heat, is antifoaming, odorless, and does not affect workers' skin.	For drilling, milling, form-milling, tapping, sawing, reaming, grinding, and turning.
Lubricant Additive	**Hyperoil**	An all-purpose industrial lubricant additive containing no sulphur, graphite, or bodying agents of any type. It is completely chemical in formulation, heat-resistant, and can be employed at temperatures as low as minus 85 degrees F.	In addition to being a lubricant, it can be used as a rust preventative and metal preservative. This material can be stored without ill effects under all temperature conditions.
Resin Sealer	**Impco RC-2**	A resin compound which is used to seal porous metal castings. Casting is impregnated with sealant, rinsed, and then cured.	For sealing castings of cast iron, magnesium, copper, and aluminum alloys within five hours.
Welding Electrode	**Inco-Rod "A"**	A multiple-purpose welding electrode that yields strong, ductile joints between a large number of metals having substantially different compositions.	Used in the joining of ferritic materials, such as mild or stainless steels.
Leaded Steels	**J & L 1213 J & L Type "A" and J & L 1113 Leaded Steels**	These steels possess a free-cutting property that facilitates the making of a smooth-finish machined surface. The lead acts as a lubricant on the cutting edge of the tool, and the steel breaks up into small chips as it is being cut.	Used in the screw machine industry for small machine parts such as hydraulic fittings, parts for automobiles, household appliances, etc.
Steel Alloy	**Jalloy Grade 3**	A general-purpose steel capable of heat-treatment which offers good resistance to abrasion or wear. This steel is available with a minimum of 0.20 per cent copper for improved resistance to atmospheric corrosion.	This alloy is being used for mine, farm, and earth-moving equipment, and wherever abrasion or wear resistance is a requisite.
Sintered Carbide	**K21**	A multi-purpose sintered carbide steel-cutting material, designed for high productivity on both high- and low-speed machines. The material has a hardness of 91.5 on the Rockwell A scale. It has high edge strength, combined with good wear qualities.	Designed for numerous machining operations. Its resistance to cratering makes its use in plunge and interrupted cutting of castings having sand inclusions and hard spots particularly effective.
Aluminum Alloy	**K186**	A high-strength aluminum alloy, with tensile strengths ranging from 38,000 to 47,000 pounds per square inch. It exhibits good forming characteristics and is corrosion-resistant.	Available in sheet and plate form, in a range of four tempers, for such uses as fabricating unfired pressure vessels, structural towers, trusses and girders, and scaffolding.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Belt Grease	**Kocour Belt Grease**	Has non-loading properties that maintain a film on abrasive belt surfaces preventing metal particles from adhering to the cutting points of the surface.	Used as a polishing aid for abrasive belt operation on both ferrous and non-ferrous metals.
Cutting Oil Additive	**Kut-O-Mite**	This material is 100 per cent inert and will not cause skin irritation or contamination.	For use as a supplement for sulphur-base (hydrocarbon) cutting oils to increase heat dissipation and eliminate tool chatter.
Fiberglass	**Lamicor**	This industrial tooling material has a tensile strength of 27,700 pounds per square inch and a compressive strength of 35,200 pounds per square inch. It can easily be fabricated into special shapes, is fire-resistant, and is easily cleaned.	For making fixtures, templates, and jigs of all kinds.
Protective Coating	**Laqua**	Preserves both electroplated and chemically cleaned surfaces. Prevents discoloration caused by oxidation, contact with sulphur fumes, humidity, salt spray and fingerprints.	Suitable for use in the metal products, sheet metal, and automotive industries for preserving newly cleaned metal surfaces.
Steel Bars	**LaSalle Large Hexagon**	C-1018 steel—made in a 3- to 4-inch size range. They are available in increasing increments of 1/4 inch.	For the production of large nuts, bolts, and other hexagon-shaped parts.
Nickel-plating Process	**Levelume**	This process combines the qualities of "full" brightness, high leveling, and exceptional speed. Activated carbon pack in filter continuously removes harmful organic contaminants, eliminating periodic batch purification.	High leveling characteristics enable the deposit to fill in scratches to a high degree, which eliminates polishing and buffing for extra smoothness after plating. Objects can be double-coated.
Chemical Sealant	**Loctite**	A liquid which hardens automatically in the joints between metal parts, sealing the joints pressure-tight and bonding parts together with a tough heat- and oil-resistant plastic.	For treating nuts, bolts and other fasteners, and sleeve joints. Also for sealing porous welds and leaky threads in pipelines and process equipment.
Aluminum Alloys	**Lurium L, L5, L10, and L20**	These high-purity aluminum alloys have a luster that is durable and non-tarnishing (produced as a result of polishing) and are easily worked using standard fabricating techniques.	For use where high-purity aluminum is required and for applications where a reflectivity of 83 per cent of a silvered mirror may be desired.
Plastic-metal Laminate	**Marvibond**	A vinyl-to-metal laminated material that combines the corrosion resistance of vinyl plastic with the formability of aluminum or steel. It can be deep-drawn, sheared, crimped, bent, embossed, etc., without damage to the coating or the bond.	For fabricating industrial and commercial equipment and parts. Users may employ automatic feeds and progressive dies that are common to regular metal coil fabrication.
Aluminum Chain	**McKay Welded Aluminum Chain**	A non-sparking, non-magnetic, lightweight and corrosion-resistant chain with a working load limit 60 per cent that of a steel chain of comparable size but weighing 65 per cent less.	Used in the chemical manufacturing, food processing, textile, petroleum refining, and explosives industries.
Die Steel	**MC-Mold and Cavity Steel**	This steel can be uniformly hardened at hardness ranges from 300 to 350 Brinell through sections as large as 20 by 10 inches. High surface hardness is obtained by carburizing and then oil-quenching.	Available in large rounds or blocks either annealed or heat-treated to a hardness of 300 Brinell. This steel is particularly suitable for molding clear plastics.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Hydraulic Oils	**Mobil D.T.E. Oils**	These eight hydraulic and circulating oils were formulated to provide desired over-all performance with respect to oxidation resistance, protection against rusting and wear, ability to separate from water, and foam resistance.	For use on hydraulically operated equipment and machines employing circulation systems.
Cobalt-molybdenum Wire	**Molybdenum Wire**	The small amount of cobalt added to this high-purity molybdenum base results in minimized wire breakage on grid-winding machines and imparts better stretch properties to the wire.	Used for grid in electronic power and receiving tubes.
Lubricant	**Molykote 165X**	Gear lubricant for highly loaded gears which can only be lubricated infrequently. The film, containing molybdenum disulphide, will not crack or peel off at temperatures as low as 0 degrees F.	For construction machinery, elevator and escalator gear trains, and mechanical presses and power shears.
Titanium Alloy	**MST 6A1-4V**	A tough alpha-beta titanium alloy which combines good hot strength with stability. It can be readily welded and heat-treated.	For elevated-temperature use. Primarily produced as a bar and forging alloy, but it also has specialized applications in sheet and plate work.
Welding Electrodes	**Murex Croloy**	Use of these electrodes reduces the need for preheating and heat-treatment subsequent to welding. The weld deposits of these electrodes exhibit good stress-rupture characteristics over a wide range of temperatures.	For use where chromium-molybdenum steels are welded in the production of equipment for high-temperature and high-pressure service.
Lead-bearing Steel	**New E-Z-Cut**	A lead-bearing steel plate that provides good machinability and good welding, polishing, and plating properties. It can be flame-cut, formed, ground, or casehardened.	Available in thicknesses ranging from 1/4 inch to 3 inches. It is used as a general-purpose free machining material.
Lead-bearing Steel	**New Rycut 50**	A fine-grained lead-bearing alloy which responds well to the conventional oil-quench and temper method of heat-treatment.	Available in bar form in both the annealed and heat-treated ready-to-use (machine straightened and stress-relieved) forms for brake dies, spindles, collets, gears, shafts, tools, etc.
Nickel-clad Strip	**Nickel-Clad Steel Strip**	This thin-gage strip can be produced in thicknesses down to 0.003 inch to tolerances as close as plus and minus 0.0001 inch and in widths down to 0.093 inch.	For making lead-in wires for electronic tubes and grid support rods where a surface of pure nickel is necessary.
Brazing Alloy	**Nicrobraz Paste**	Paste form of Nicrobraz stainless-steel brazing alloy. Easy to apply and easy to fuse. Paste permits torch and induction brazing where brazing under vacuum or controlled atmospheres is not feasible.	For use in all types of brazing applications involving stainless steels, nickel-base, cobalt-base, and similar alloys, as well as low-alloy steels, carbon steels, and copper.
Plastics Cement	**3799 Metagrip**	A clear cement for adhering metalized plastic to itself or to plain plastic without causing the metallic finish to peel or run.	Applied by brush, spray, dip, or squeeze applicators for bonding such materials as metalized acetate, butyrate, or polystyrene.
Aluminum Alloy	**5083**	A non-heat-treatable alloy which can be welded rapidly (with no preheating) by using the inert-gas arc-welding method.	Used in aluminum fabrication and welding of such items as ships, trucks, and railroad cars.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Adhesive Tape	No. 131 Behr-Cat Flatback Tape	This high-strength, high-adhesive paper tape can support a weight of at least 45 pounds without breaking, can withstand temperatures up to 250 degrees F., and leaves no deposits upon removal.	For holding protective coverings in place during equipment manufacture and for packaging machine tools and other equipment for storage.
Sealing Compound	No. 576.1 Permagum	A white mastic sealer that is non-staining, non-hardening, and odorless. The sealer is extruded in handy beads, tapes, and ribbons that can easily be thumbed into slots, holes, crevices, and cracks to seal against water, vapor, dust, or air.	This compound has been found to be particularly useful in the automotive, refrigeration, and air-conditioning industries.
Nylon Tubing	Nylaflow	A flexible nylon tubing with a burst rating of 2500 pounds per square inch. It can withstand more than 400 flexes per minute, can be bent to a radius of 2 1/2 inches, and is resistant to alkalies and practically all solvents.	Used on metalworking equipment for conveying lubricants, water, plastic spray, and air.
Nylon Fastenings	Nylo-Fast	Fastenings lock in place and do not loosen under vibration. They resist high voltages at commercial frequencies, withstand heat up to 450 degrees F., and are unaffected by commercial solvents, alcohols, and oils.	These fastenings are offered on an on-hand stock inventory basis and include many of the popular sizes of machine screws.
Metal Coating	Oakite Chromi-Coat	A conversion coating for aluminum and zinc which imparts corrosion resistance and improves paint adherence.	Designed to meet Specification MIL C-5541. It is used for protecting and providing a paint-adhering surface.
Aluminum Etchant	Oakite Composition No. 160	This material is readily soluble in water to form working solutions having a long life. Hot or cold water can be used in rinsing. No troublesome fumes are given off.	Provides a rapid, uniform controlled etch on aluminum and eliminates the troublesome problem of hard sludge build-up on equipment surfaces.
Electrocleaning Material	Oakite Composition No. 191	An electrocleaning material which reduces the tarnishing of copper and its alloys in the high-temperature cleaning ranges. Advantages claimed for the material are a long solution life and broad current-density and temperature ranges.	Used to reduce the tarnishing of copper and its alloys. It cleans at low concentrations, removes buffing dirt and other common soils rapidly, and is rinsable in water.
Cleaning Compound	Oakite Compound No. 131	The compound is a non-viscous, amber-colored liquid that is soluble in water or alcohol in all proportions.	For the removal of rust, heat scale, tarnish, and other oxides from ferrous metal parts.
Coating Material	Oakite Crys-Coat SW	A zinc phosphate coating material for iron and steel designed for use in pressure-spray washing machines. It is fine-grained, dense, and relatively non-porous.	For coating iron and steel parts to protect them from the effects of corrosion.
Liquid Pickle Control	Oakite Pickle Control No. 5	A liquid inhibitor for sulphuric, hydrochloric, or phosphoric acid, or mixtures thereof which also provides a controlled foam blanket on pickling solutions. It is a viscous red-brown liquid with a characteristic odor.	Designed for use in continuous steel-strip mills, where the addition of an inhibitor through proportioning equipment is preferred, and in batch pickling operations.
Stripper	Octastrip 31	This paint and varnish stripper is non-flammable, is used with cold water, and can be rinsed.	Applications include the stripping of almost all organic coatings from various parts.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Die Steel	Ottawa 60	A high-carbon, high-vanadium die steel with good wear resistance which is produced in bars and forgings. This steel may be forged, annealed, hardened, and tempered. It does not machine as well as high-carbon, high-chromium tool steels.	Designed for making dies for deep-drawing and forming of stainless steel without galling or pick-up.
Beryllium-copper Strip	Penntemp	A mill-hardened or pretempered beryllium copper which offers the features of regular age-hardening beryllium copper yet requires no heat-treatment. It offers high strength, hardness, good fatigue resistance, conductivity, and corrosion resistance.	Available in five tempers in thicknesses from 0.001 to 0.025 inch and in widths from 1/8 inch to 5 inches for various applications.
Bonding Process	Permadizing	A rubber-to-metal bonding process that provides parts that are precise, flash-free, and smooth. Parts exhibit low swell and are resistant to aromatic fuels and hydraulic fluids.	Bonds aluminum to various rubber, synthetic rubber, or silicone compounds. Can also be used for parts operating in extreme temperature and pressure ranges.
Stainless-steel Alloys	PH55A PH55B PH55C PH20	A series of corrosion-resistant precipitation-hardenable stainless-steel alloys which were formulated for one or more of the following qualities: high strength, high hardness, shock resistance, corrosion resistance, and gall resistance.	For the production of parts requiring the specific qualities inherent in these alloys.
Floor Absorbent	Pickup	An industrial floor absorbent which soaks up more than its own weight in oil, greases, and other fluids. This material is unaffected by heat or cold, and it can be stored for long periods.	For use on industrial floors. It provides a dry, non-slip floor surface which helps to reduce personnel injuries and fire hazards.
Tooling Compound	Plastik-Tul	A viscous, metal-filled plastic material which can be molded like putty or poured into a form. It can be drilled, tapped, threaded, milled, broached, sawed, painted, or plated and is unaffected by cutting oils, solvents, and greases.	For making jigs, fixtures, plugs, gages, forming dies, holding fixtures, and masking fixtures.
Plastic	Polypenco K-51	A plastic having mechanical strength, heat and chemical resistance, dimensional stability, and free machinability. Resists the effects of alkalies and acids.	Available in rod form. It is used for bearings, rollers, gears, pump impellers, valve seats, gaskets, packings, and parts used to control the flow of liquids.
Protective Coating	Porcenell	A silicate or glass-like protective coating material which is fused to any clean ferrous metal surface at temperatures ranging from 900 to 1200 degrees F. The coatings are claimed to be fire-proof, scratch-resistant, and to have a permanence of color.	Applied by spray, brush, or dipping methods, and then fired, these materials are used to coat the surfaces of sheet and plate steel; cast, wrought, and malleable iron; and high-carbon steels.
Silver-alloy Sheets	Porous Silver Alloy	A porous silver material which may be impregnated easily with various lubricants. It is capable of carrying bearing loads of 50 to 75 per cent of those carried by solid silver bearings.	For use as a bearing liner material.
Protective Coating	Proseal No. 16	A chromate conversion protective coating which inhibits corrosive action between paint and aluminum.	Designed for any application where extruded, forged, wrought, or cast aluminum and its various alloys are employed.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Penetrant	**Puritan Penetrant**	An odorless chemical formulation applied by pour spout or squirt gun. Several minutes after application the work can be struck lightly with a hammer and the parts disassembled by using the proper tools.	For loosening corroded nuts or bolts or larger seized parts of mechanical equipment.
Strippable Coating	**PV-845**	Aluminum-pigmented strippable coating which requires no surface preparation and can be stripped easily without leaving a greasy residue. Applied by either brush or spray methods.	Used on all types of metals during both inside and short-term outside storage. For polished surfaces to prevent marring and scratching.
Protective Coating	**R-12 Protective Coating**	A very thin protective lubricating film that provides corrosion protection and moisture resistance. Film will not run or drip at 200 degrees F. or gum or harden at minus 20 degrees F.	Application is made with any suitable oiler, spray gun, brush, or cloth or by dipping. Effective on all types of metals.
Titanium Fasteners	**RC 130B Wire Fasteners**	These fasteners exhibit a minimum tensile strength of 150,000 pounds per square inch and a minimum shear strength of 95,000 pounds per square inch.	The weight-saving possibilities of these fasteners are of particular interest to builders of airframes and engines.
Epoxy-resin Adhesive	**Resiweld**	This adhesive is resistant to solvents, grease, water, chemicals, and severe conditions of treatment and exposure. It sets and cures without the use of clamps. The bonds formed are permanent, have high strength and good impact resistance.	For permanently bonding ferrous and non-ferrous metals, glass, wood, rubber, and plastic surfaces to themselves and to each other.
Aluminum Alloy	**Revere Alloy 6263**	A lightweight high-strength aluminum-alloy conductor material.	Available in both the T6 and T8 tempers. It is used as an electrical conductor material.
Casehardening Compound	**Royal Hardening Powder**	This casehardening compound developed to replace cyanide and thereby eliminate poisonous fumes provides a case depth of 0.01 to 0.02 inch.	Provides a simple method for the quick surface-hardening of steel tools, dies, parts, and cutting implements.
Brazing Alloy	**RSNI**	This alloy does not flatten out at the brazing temperature to form thin fillet edges. However, because of this sluggishness, particular care is required to flow the material into the joint.	For use in overcoming crevice corrosion problems prevalent in brazing the 400 series straight chromium stainless steels.
Corrosion-resistant Paint	**Rubalt "RA"**	This paint is non-porous and flexible and has good adhesive properties. It resists the action of many acids and alkalies and requires no primer or pretreatment.	This black corrosion-resistant paint which looks like patent leather and has a rubbery feel is used to coat many varied metal surfaces including machines and structures.
Rust-preventive Spray	**Rust Chek**	The compound is packaged in a 12-ounce aerosol spray container which deposits a clear dry waxy film with a thickness of 0.005 inch. Treated surface will not absorb dust or dirt.	Provides complete protection for tools, dies, molds, machinery, and metal surfaces during storage periods and in transit under the most adverse atmospheric conditions.
Stripper	**Rustgon**	This stripper contains no cyanide compounds, requires no electrolytic action, and gives off no corrosive fumes. Parts to be treated are dipped into a tank, then withdrawn and rinsed with air and water or with steam.	This non-acid material strips paint, rust, and primer from ferrous metal surfaces.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Aluminum Alloy	Salloy	A match-plate metal used on jobs where a highly polished surface is required. This alloy is close-grained and takes a good finish.	For making match-plates in the foundry and die-casting industries. It is also used as a casting metal for special applications.
Laminated Sheeting	Scotchply Reinforced Plastic	A high-strength, corrosion-resistant, uniform-quality, glass-in-plastic laminated sheeting that is moldable by using ordinary methods. It can be sawed, sheared, punched, drilled, sanded, painted, etc.	Adaptable for the matched metal or plastic die method of molding as well as other commonly known molding techniques in use today.
Beryllium-copper Wire	Silvercote Tempered Beryllium-Copper Wire	This wire has an ultimate tensile strength of 185,000 pounds per square inch and is sufficiently ductile to be wrapped around its own diameter. It is corrosion-resistant, electrically conductive, non-magnetic, and silver plated.	For forming into strings, wire rope, and complex shapes. The silver plating allows easy soldering and provides low-resistance electrical contact.
Glass-cleaning Abrasive	Steeletts	A steel-grit abrasive that has the same hardness range as chilled iron abrasives but is free from brittle carbides. Abrasive particles do not chip upon contact, and their shape endures for hundreds of cycles.	Used to provide a deep etch on metallic surfaces for bonding, to provide luster on non-ferrous work, for descaling alloy forgings and heat-treated work, and for etching steel mill rolls.
Steel Bars	Stressproof Steel Bars	These bars can easily be machined and have the strength and wearability of practically any alloy or heat-treated carbon-steel bar.	For plant maintenance departments. Round and hexagonal bars are available which will handle practically any repair job.
Polystyrene Plastics	Styron 429, 440, 665, and 689	A group of four polystyrene compounds that possess one or more of the following properties: good surface finish, high flexural strength, heat resistance, impact strength, moldability, and chatter and crack resistance.	For vacuum forming of products in thin extruded sheets; for molding radio cabinets, housings, etc.; for general shape extrusions; and also for high-speed automatic molding operations of large cross-sectional area parts.
Paste Solder	SweTite Paste Solder	A half-and-half blend of powdered solder and an active flux which requires no prior cleaning for most applications. Joints obtained are as strong as those made by conventional methods.	For sweat soldering or tinning. Paste is applied with a brush or a cloth, the parts are fitted together, and heat is applied.
Temperature Indicator	Tempil° Pellet for 100 Degrees F.	These temperature-indicating pellets liquefy along the line of contact between the pellet and the surface when the surface reaches a temperature of 100 degrees F.	For testing the effectiveness of insulations, regulating heating and cooling systems, testing prototypes for heat-transfer characteristics, and testing work in the production line.
Drawing Compound	Texaco Drawing Compound No. 3	This drawing compound which is water-miscible in ratios ranging from equal parts to 1 to 15 parts is a mixture of mineral oil, emulsifying agents, non-abrasive pigment, and a dispersion additive which insures against its caking on dies and knockout or stripper mechanisms.	For handling work being processed under difficult forming conditions. It prevents metal-to-metal contact which virtually eliminates die galling, sticking, and seizure. The compound is easily removed by washing with water.
Coolant	Texaco Soluble Oil HD	A heavy-duty emulsive coolant with extreme-pressure properties. Mixes readily with hard or soft water to form a highly stable emulsion with good rust-inhibiting properties.	Used with carbide and high-speed steel tools in automatic operations and, in many instances, in place of a cutting oil.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Iron Alloy	Tisco 150-Y	An extremely hard, abrasion-resistant iron alloy capable of being heat-treated to 700 Brinell.	Applications include the fabrication of equipment used for handling abrasive materials.
Surface Preparation	Totrust Metal-Bond (Clear)	A clear metal coating which assures adhesion of paint films to smooth surfaces such as galvanized sidings, aluminum sheets, and painted signs. When dry, it acts as an adhesive for paints and also as a protective coating.	Applicable by brush or spray to surfaces that are dry and free of grease, oil, and loose particles. Besides metal surfaces, it can be used on bare wood, plastic, wallboards, and cement-asbestos board.
Grease Cartridges	Tower Grezall	A factory-packed grease cartridge which prevents deterioration and contamination of the grease by dirt, grit, and moisture.	Enables grease gun to be loaded without the work, waste, or inconvenience of filling from a pail or drum.
Cutting Oil	Transultex Cutting Oil B HD	An easily removable extreme-pressure cutting oil that is transparent. Transparency facilitates visual inspection of pieces undergoing machining.	For use in practically all cutting, broaching, threading, and similar operations.
Degreasing Solvent	Triclene D	A trichlorethylene vapor degreasing solvent developed to resist all the major causes of solvent breakdown. It resists the effects of light-metal chlorides, light, air, heat, and acids. It contains no elements that tend to harm or stain the work it cleans.	Used in small vapor units as well as multiple-compartment conveyorized degreasers. Tank truck quantities are available to users capable of storing large amounts in their plants.
Barrel-finishing Abrasives	Tumblex T Tumblex N	Two abrasives—the T-formulation consisting of triangular-shaped pieces of Alundum vitrified-bonded abrasive which was developed to overcome the problem of wedging of abrasive in parts being tumbled and the N, which cuts slowly, has little breakdown and produces a bright color and luster.	For fast barrel cutting without the use of cutting compounds. Used on die-castings and on steel, zinc, brass, aluminum, and stainless-steel parts.
Stainless-steel Tubing	Types 304 and 321 Weldrawn	Obtainable in outside diameters up to 2 1/16 inches. Wall thicknesses range from 0.006 to 0.025 inch.	For making bellows, low-pressure heat-exchanger tubes, flexible hose, aircraft ducting, fractional-horsepower motor casings, ceramic drills, etc.
Rust-preventive Coatings	Ucon	A series of rust-preventive fluids that can be burned cleanly from metal surfaces after storage. They do not leave residues after burning that interfere with painting, welding, soldering, brazing, or annealing.	For coating metal parts before storage to prevent their rusting.
Nickel Alloy	Udimet 500	A centerless-ground hot-rolled nickel-alloy bar stock which has an ultimate tensile strength of 160,000 pounds per square inch at 1350 degrees F. Average hardness, as heat-treated, is 38 to 40 on the Rockwell C scale.	Available in sizes from 1/2 inch to 2 inches in diameter. This alloy has been developed for use as gas-turbine components and other parts requiring strength at elevated temperatures.
Marking Materials	Vaporite Industrial White Ink and Jiffy-Rite Fountain Pen	A white ink and accompanying fountain pen that can make white markings on dark, flexible, and highly polished surfaces which will neither flake nor rub off and are resistant to cutting oils and coolants. Solvents furnished with the materials remove the ink easily when desired.	For circling defective holes and rivets, marking parts for production-line assembly, code marking, and masking of templates before flushing with cutting oils.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Silicone Lubricants	**Versilube F-50** **Versilube G-300**	These compounds lubricate about as well as petroleum oils and greases and yet retain all the typical silicone characteristics—such as an operating temperature range of from minus 100 to plus 400 degrees F. The F-50 compound is a fluid, and the G-300 a grease.	Suitable for use in hot industries such as the glass, steel, ceramics, and petroleum industries. Also applicable to sleeve-bearing and ball-bearing motors, clocks, timers, instruments, etc.
Hard-facing Alloy	**Walloy No. 6**	A chromium-cobalt-tungsten hard-facing alloy available in welding-rod form which has high impact strength and corrosion and abrasion resistance.	Edger rolls and swaging mandrels, engine exhaust valves and seats, dies, etc. may be suitably hard-faced with this alloy.
Abrasive Cloth	**Wetordry Fabricut**	A "self-cleaning" cloth mesh coated on both sides with mineral grain bonded to the cloth with a heat-resistant waterproof resin.	Can be used for either wet or dry, hand or machine sanding.
Coating Process	**Whirlclad**	A method of coating metals, ceramics, glass, and wood with various types of plastic materials. No plasticizers or solvents are used. Coating thickness ranges anywhere from 0.008 to 0.040 inch.	For coating such wear parts as jigs and fixtures, rollers, bushings, loading hooks, sliding surfaces, and such corrosion-resistant parts as valve bodies, fans, and ducts.
Silicone Lubricants	**X-520** **X-521** **X-522** **X-525** **X-526** **X-527**	Lubricants exhibit unusual lubricating and solubility properties, have good release properties, are stable, and lubricate and impart anti-wear properties in a manner similar to petroleum oils.	Used as special lubricants, as release agents for rubber and plastics, and as emulsifying agents or emulsion breakers.
Aluminum Forging Alloy	**X7079**	Exhibits uniformity of properties in heavy sections and good ductility in cross-grained directions. Forgings up to 7 inches in thickness and heat-treated in full section exhibit a tensile strength of 73,000 pounds per square inch in the longitudinal direction.	This material is used for making forgings for the aircraft industry. It is highly resistant to stress corrosion cracking and is not susceptible to distortion during machining.

Names and Addresses of Manufacturers of Products Listed

Acrawax C Atomized—Glyco Products Co., Inc., Empire State Bldg., New York 1, N. Y.

Aircosil Alloys and Flux—Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

Airtemp Plasti-Metal 707—Aries Laboratories, Inc., 270 Park Ave., New York 17, N. Y.

All-State No. 105 Solder and All-State No. 107 Silver Solder—All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y.

Aluminum Serviron—Xzit Chemical Co., 158 14th, Hoboken, N. J.

AM350 – Allegheny Ludlum Steel Corpn., Oliver Bldg., Pittsburgh 22, Pa.

Anti-Rust Cleaner CP – Haviland Products Co., 421 Ann St. N.W., Grand Rapids, Mich.

Arcosite Flux and Chromar – Arcos Corpn., 1500 S. 50th St., Philadelphia 43, Pa.

Armor-Kut (R) – Coated Abrasives Division, Armour & Co., Alliance, Ohio.

ATR Series Woven—Friction Division, Thermoid Co., Trenton, N. J.

Aur-O-Met 56 and 57—Aurora Metal Co., Aurora, Ill.

Baby Hexteel Surface Armor – Klemp Metal Grating Corpn., 6603 S. Melvina Ave., Chicago 38, Ill.

Bear Penetrating Oil—House of Laurila, 18483 Braile, Detroit, Mich.

Beryllium-Copper Strip – American Silver Co., Inc., 36-07 Prince St., Flushing 54, N. Y.

Blue Label Stainless-Steel Wire, Type 302—Webb Wire Division, Carpenter Steel Co., New Brunswick, N. J.

"Bondized" Califilm and "Bondized" Kelon-F – Shamban Engineering Co., 11617 W. Jefferson Blvd., Culver City, Calif.

Bondmaster M615, M616, and M620 —Rubber & Asbestos Corpn., 225 Belleville Ave., Bloomfield, N. J.

Brinalloy—Lunkenheimer Co., Beekman, Waverly and Tremont, Cincinnati, Ohio.

Brooks Rollene EC—Brooks Oil Co., 934 Ridge Ave., Pittsburgh 12, Pa.

Names and Addresses of Manufacturers of Products Listed

CA-606 and CA-609—Carmet Division of Allegheny Ludlum Steel Corpn., Pittsburgh 22, Pa.

Carpenter Stainless No. 7-Mo (Type 329)—Carpenter Steel Co., Reading, Pa.

C-Flux—American Solder & Flux Co., 19th and Willard Sts., Philadelphia 40, Pa.

Chromewear—Vanadium-Alloys Steel Co., Latrobe, Pa.

Class 700—Silicone Products Department, General Electric Co., Waterford, N. Y.

Coast Metals 50—Coast Metals, Inc., Little Ferry, N. J.

Cohrlastic HT 655 and HT 666—Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.

Colmonoy No. 2 and No. 70—Wall Colmonoy Corpn., 19345 John R St., Detroit 3, Mich.

Corfoam 114—Rezolin, Inc., 5736 W. 96th St., Los Angeles, Calif.

'dag' Dispersion No. 217—Acheson Colloids Co., Port Huron, Mich.

DC-50—Donegal Mfg. Co., Marietta, Pa.

Devcon F—Chemical Development Corpn., Danvers, Mass.

Dow Magnesium Sheet and Extrusions—Dow Chemical Co., Midland, Mich.

Ductile Ni-Resist — International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Duro Aluminum Shell Coating—Industrial Division of Woodhill Chemical Co., 1391 E. 33rd St., Cleveland 14, Ohio.

Epocast and Epocast 13 — Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif.

F132—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Fatigue Proof — LaSalle Steel Co., 1412 150th St., Hammond, Ind.

Ferrox—American Abrasive Metals Co., Irvington, N. J.

Fibre Forms—Fibre Forming Division, Arvey Corpn., Olean, N. Y.

Firthite TXL—Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Gard Anti-Rust Spray—Gard Industries, Inc., 733 Green Bay Road, Wilmette, Ill.

G-E Textolite (R) Cold Punch 11570—General Electric Co., Chemical & Metallurgical Division, Pittsfield, Mass.

Gorlube—Goshen Rubber Co., Inc., P. O. Box 517, Goshen, Ind.

Grade CA-608 and CA-610—Carmet Division, Allegheny Ludlum Steel Corpn., Pittsburgh 22, Pa.

Grade 330 and 860—Metallurgical Products Department, General Electric Co., Detroit 32, Mich.

Harvey Hollow Bar—Harvey Aluminum, 19200 Southwestern Ave., Torrance, Calif.

Hasko-Preg—Haskelite Mfg. Corpn., Grand Rapids, Mich.

Hayden Drill Blanks—Hayden Twist Drill Co., 8626 Lyndon Ave., Detroit 38, Mich.

Hevimet—Metallurgical Products Department, General Electric Co., 11147 E. Eight Mile Ave., Detroit 32, Mich.

Homalite CR-39—Homalite Corpn., 11-13 Brookside Drive, Wilmington, Del.

Hypercut XX—Destiny Products Co., 2970 W. Grand Blvd., Detroit 2, Mich.

Hyperoil — Destiny Products Co., 2970 W. Grand Blvd., Detroit 2, Mich.

Impco RC-2—Impco, Inc., Cranston, R. I.

Inco-Rod "A"—International Nickel Co., Inc., Bayonne, N. J.

J & L 1113, 1213, and Type "A" Leaded Steels—Jones & Laughlin Steel Corpn., 3 Gateway Center, Pittsburgh 30, Pa.

Jalloy Grade 3—Jones & Laughlin Steel Corpn., 3 Gateway Center, Pittsburgh 30, Pa.

K21—Kennametal Inc., Latrobe, Pa.

K186—Kaiser Aluminum & Chemical Corpn., 1924 Broadway, Oakland 12, Calif.

Kocour Belt Grease — Kocour Co., 4800 S. St. Louis Ave., Chicago 32, Ill.

Kut-O-Mite—Iso-Mite Corpn., 4470 E. Washington Blvd., Los Angeles 23, Calif.

Lamicor—Strick Plastics Corpn., 31-06 38th Ave., Long Island City, N. Y.

Laqua—Fidelity Chemical Products Corpn., 470-474 Frelinghuysen Ave., Newark, N. J.

LaSalle Large Hexagon — LaSalle Steel Co., P. O. Box 6800A, Chicago, Ill.

Levelume — Hanson-Van Winkle-Munning Co., Matawan, N. J.

Loctite — American Sealants Co., Trinity College, P. O. Box 260, Hartford 6, Conn.

Lurium L, L5, L10, and L20—Fromson Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y.

Marvibond—Enamelstrip Corpn., Allentown, Pa.

McKay Welded Aluminum Chain—McKay Co., 323 McKay Bldg., Pittsburgh 22, Pa.

MC-Mold and Cavity Steel—Vanadium-Alloys Steel Co., Latrobe, Pa.

Mobil D.T.E. Oils—Socony Mobil Oil Co., Inc., 26 Broadway, New York 4, N. Y.

Molybdenum Wire—Fansteel Metallurgical Corpn., North Chicago, Ill.

Molykote 165X — Alpha Molykote Corpn., 65 Harvard Ave., Stamford, Conn.

MST 6A1-4V—Mallory-Sharon Titanium Corpn., Niles, Ohio.

Murex Croloy—Metal and Thermit Corpn., 100 E. 42nd St., New York 17, N. Y.

New E-Z-Cut and New Rycut 50—Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.

Nickel-Clad Steel Strip—American Silver Co., 36-07 Prince St., Flushing 54, N. Y.

Names and Addresses of Manufacturers of Products Listed

Nicrobraz Paste—Stainless Processing Division, Wall Colmonoy Corpn., 19345 John R St., Detroit 3, Mich.

3799 Metagrip—Adhesive Products Corpn., 1660 Boone Ave., New York 60, N. Y.

5083—Kaiser Aluminum & Chemical Corpn., 1924 Broadway, Oakland 12, Calif.

No. 131 Behr-Cat Flatback Tape—Behr-Manning Division, Norton Co., Troy, N. Y.

No. 576.1 Permagum—Presstite Engineering Co., 3798 Chouteau Ave., St. Louis 10, Mo.

Nylaflow—Polymer Corpn. of Pennsylvania, 125 N. 4th St., Reading, Pa.

Nylo-Fast—Anti-Corrosive Metal Products Co., Inc., 1234 River Road, Castleton-on-Hudson, N. Y.

Oakite ChromiCoat—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Oakite Composition Nos. 160 and 191; Compound No. 131; CrysCoat SW; Pickle Control No. 5—Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

Octastrip 31—Octagon Process, Inc., 15 Bank St., Staten Island, N. Y.

Ottawa 60—Allegheny Ludlum Steel Corpn., 2020 Oliver Bldg., Pittsburgh 22, Pa.

Penntemp—Penn Precision Products, Inc., 501 Crescent Ave., Reading, Pa.

Permadizing—Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.

PH55A, PH55B, PH55C, and PH20—Research Division, Cooper Alloy Corpn., Hillside, N. J.

Pickup—Diversey Corpn., 1820 Roscoe St., Chicago 13, Ill.

Plastik-Tul—Industrial Development & Mfg. Corpn., Needham, Mass.

Polypenco K-51—Polymer Corpn. of Pennsylvania, Reading, Pa.

Porcenell—Allied Porcenell, Inc., 851 S. Market St., Waukegan, Ill.

Porous Silver Alloy—Micro Metallic Corpn., 30 Sea Cliff Ave., Glen Cove, N. Y.

Proseal No. 16—Promat Division, Poor & Co., 851 Market St., Waukegan, Ill.

Puritan Penetrant—Olin Mathieson Chemical Corpn., 10 Light St., Baltimore, Md.

PV-845—Specialty Coatings, Inc., 1085 Allegheny Ave., Oakmont, Pa.

R-12 Protective Coating—American Grease Stick Co., Muskegon, Mich.

RC 130B Wire Fasteners—Camcar Screw & Mfg. Corpn., 629 18th Ave., Rockford, Ill.

Resiweld—H. B. Fuller Co., 181 W. Kellogg Blvd., St. Paul 2, Minn.

Revere Alloy 6263—Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

Royal Hardening Powder—Anti-Borax Compound Co., Inc., 1506 Wall St., Fort Wayne 6, Ind.

RSNI—Handy & Harman, 82 Fulton St., New York 38, N. Y.

Rubalt "RA"—Alfred Hague & Co., 227 34th St., Brooklyn 32, N. Y.

Rust Chek—Eastern Aerosol Products Co., Newfoundland, N. J.

Rustgon—Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

Salloy—Metallurgical Department, George Sall Metals Co., 2300 E. Butler St., Philadelphia 37, Pa.

Scotchply Reinforced Plastic—Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

Silvercote Tempered Beryllium-Copper Wire—Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson, N. J.

Steeletts—Wheelabrator Corpn., 1147 S. Byrkit St., Mishawaka, Ind.

Stressproof Steel Bars—LaSalle Steel Co., 1412 150th St., Hammond, Ind.

Styron 429, 440, 665, and 689—Dow Chemical Co., Midland, Mich.

SweTite Paste Solder—Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J.

Tempil° Pellet for 100 Degrees F.—Tempil° Corpn., 132 W. 22nd St., New York 11, N. Y.

Texaco Drawing Compound No. 3 and Soluble Oil HD—Texas Co., 135 E. 42nd St., New York 17, N. Y.

Tisco 150-Y—Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Totrust Metal-Bond (Clear)—Wilbur & Williams Co., 130 Lincoln St., Brighton, Mass.

Tower Grezall—Tower Oil Co., 300 W. Washington St., Chicago 6, Ill.

Transultex Cutting Oil B HD—Texas Co., 135 E. 42nd St., New York 17, N. Y.

Triclene D—Electrochemicals Department, E. I. du Pont de Nemours & Co., Wilmington, Del.

Tumblex T and N—Norton Co., Worcester 6, Mass.

Types 304 and 321 Weldrawn—Superior Tube Co., Germantown Ave., Norristown, Pa.

Ucon—Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y.

Udimet 500—Utica Drop Forge & Tool Corpn., Utica, N. Y.

Vaporite Industrial White Ink—Time Saving Specialties, 2816 Dupont Ave., South Minneapolis, Minn.

Versilube F-50 and G-300—Silicone Products Department, General Electric Co., Waterford, N. Y.

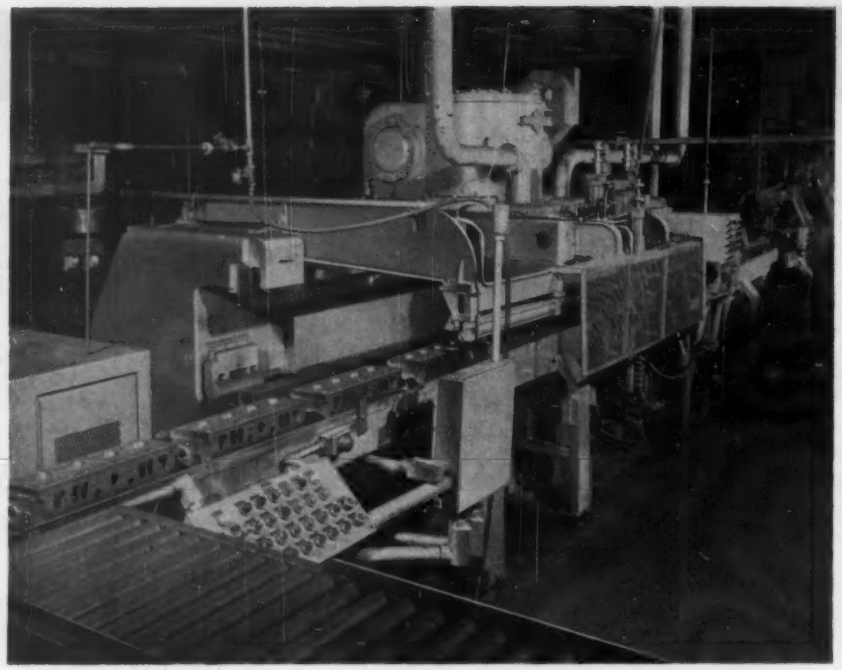
Walloy No. 6—Wall Colmonoy Corpn., 19345 John R St., Detroit 3, Mich.

Wetordry Fabricut—Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

Whirlclad—Polymer Processes Inc., Reading, Pa.

X-520, X-521, X-522, X-525, X-526, and X-527—Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

X7079—Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.



Automatic Broaching of Cylinder Heads

COMPLETELY automatic loading, broaching, and unloading of cylinder heads are important phases in the mass production of Strato-Streak V-8 engines at the Pontiac Motor Division, General Motors Corporation, Pontiac, Mich. Broaching of large castings such as blocks and heads has always been a major stumbling block to the complete automation of engine manufacturing facilities. This problem has been solved by finishing the combustion-chamber gasket surfaces of the cylinder heads on the Colonial ElectroGear 60-ton horizontal broaching machine shown in the heading illustration.

Cast cylinder heads to be finish-broached are supplied from two W. F. & John Barnes transfer machines, one of which can be seen at the extreme right. A Wilson air-operated automation unit, Fig. 1, takes cylinder heads from a conveyor—located at right angles to the broaching machine and connected to the first transfer machine—and also from the unloading end of the second transfer machine. The automation unit feeds the cast heads into a loading station, located at the right-hand end of the broaching machine.

A hydraulically operated transfer bar moves the work-piece from the loading station into a trunnion type fixture, Fig. 2, at the center of the machine. This fixture is hydraulically swung upward through an angle of 90 degrees, thus positioning the cylinder head for the broaching pass. The head is located from a previously machined oil-pan rail surface and hydraulically clamped.

At the completion of the broaching pass, the fixture is automatically swung down, and another part is fed into position for broaching. Simultaneously, the finish-broached cylinder heads are automatically unloaded from the machine, as seen at the left in the heading illustration. While the ram speed is infinitely variable from 30 to 150 surface feet per minute, the machine is currently set for 130 feet per minute—resulting in a production of 225 cylinder heads per hour.

Approximately 0.015 inch of stock is removed from each combustion-chamber gasket surface, and tolerance is maintained within plus or minus 0.001 inch, despite the high production rate. Solid carbide blades are employed for this operation. Chips are automatically removed by a chain conveyor, located in a trench below the machine. Since the cycle is completely automatic, an operator is only needed for occasional tool changes or maintenance.

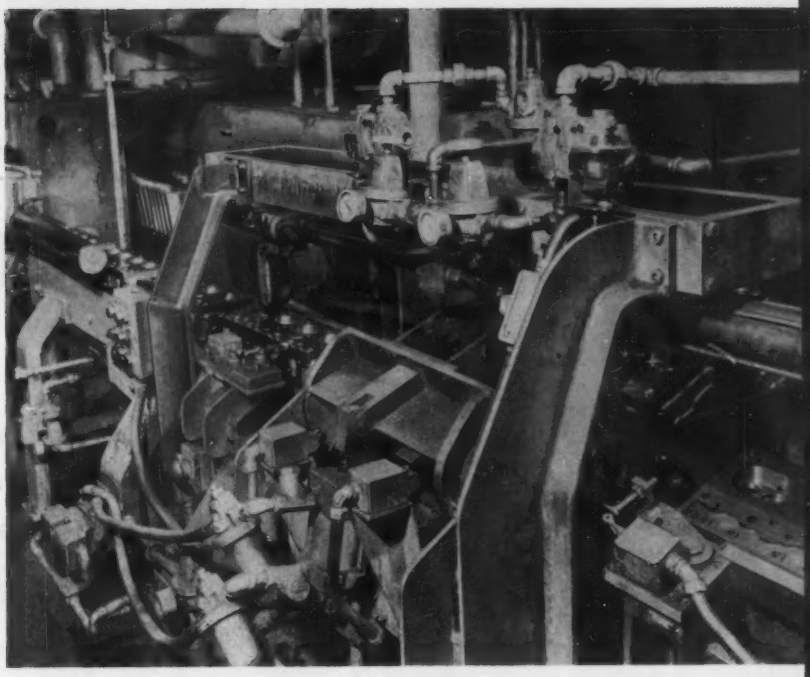


Fig. 1. Air-operated automation unit receives cylinder heads from two transfer machines and automatically feeds them into loading station of the broaching machine seen at the left.

Power for the broaching ram is supplied from a direct-current motor generator set. The motor is coupled to a gear-box containing a Cone-Drive double enveloping worm-gear set driving a precision helical pinion. The pinion drives a rack mounted directly to the ram. This arrangement produces the smooth surface finish essential for the high-compression Strato-Streak engine without the need for further processing of the gasket surfaces.

All the hydraulic and electrical controls on the machine are interlocked to insure safe operation. Also, a bumper type pressure overload device, seen mounted near the left-hand end of the machine frame, prevents the broach ram from leaving the machine during the operation.

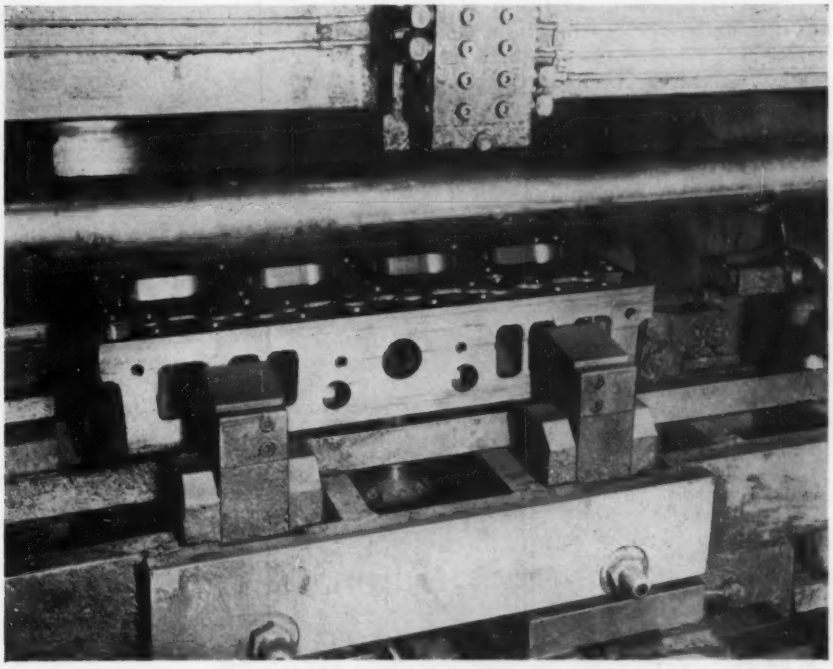
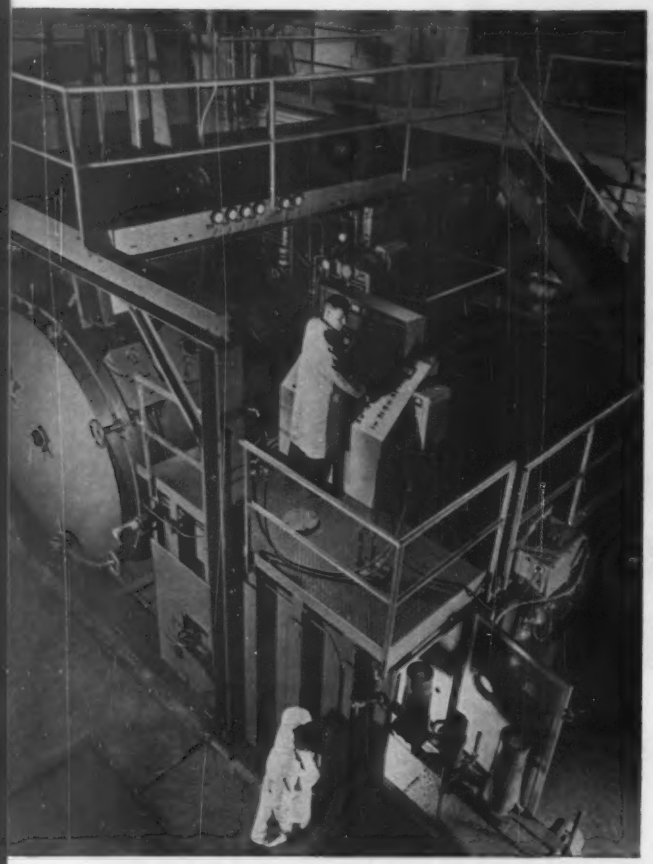


Fig. 2. Trunnion type fixture, located at center of broaching machine seen in the heading illustration, swings cast head upward through an angle of 90 degrees into the broaching position.

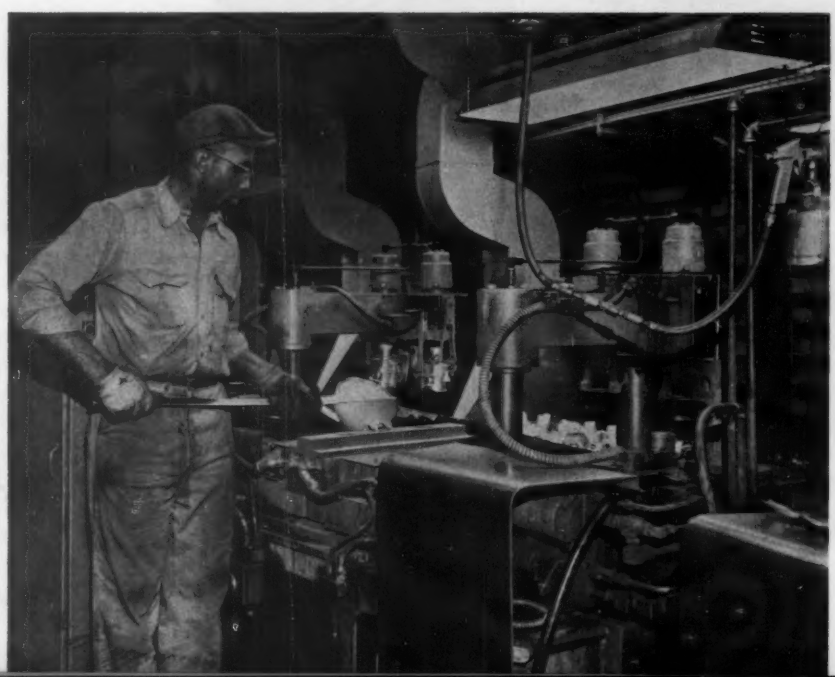
In Shops Around the Country

Camera highlights of some interesting operations performed in various metalworking plants

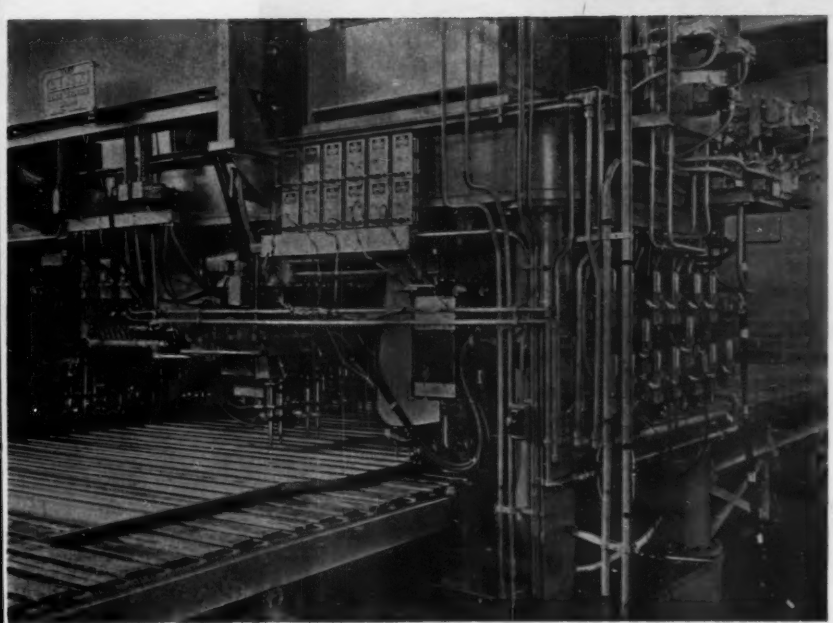


Removing hot ingots from a vacuum chamber of the recently opened induction vacuum department of Allegheny Ludlum Steel Corporation, at Watervliet, N. Y. The melting furnace is located in the tank on the left. Chambers are arranged to permit continuous operation of the unit.

Molten aluminum is poured into the molds of one of sixteen new automatic casting machines at Chrysler's Highland Park, Mich., piston foundry. Mechanical arms hold two pistons that have just been removed from the machine.

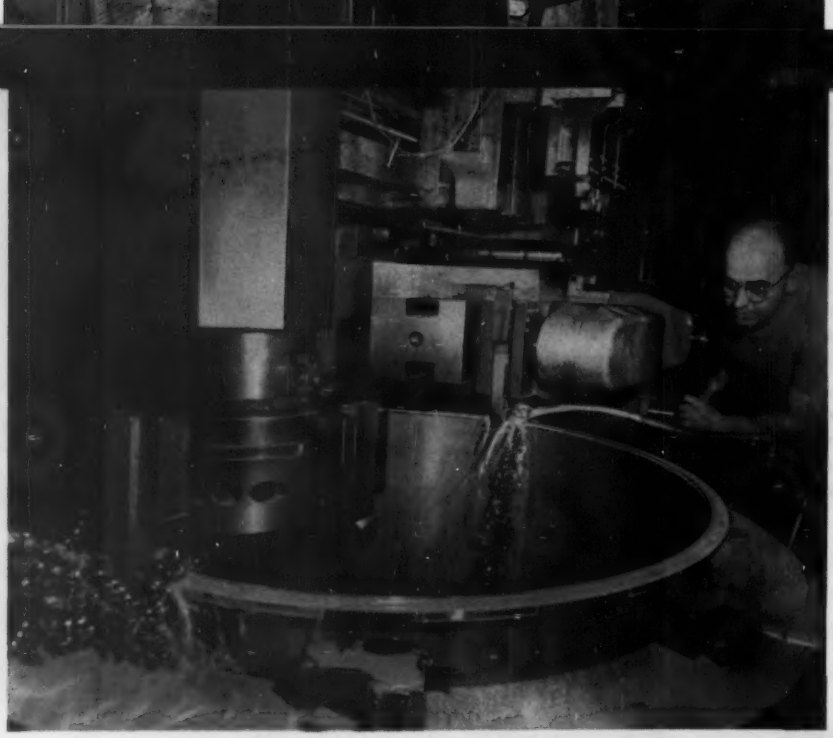


Straightening 20-foot lengths of tubing at the Mackenzie Walton Co., Pawtucket, R. I. The machine is a Mackintosh-Hemphill rotary straightener, having three sets of opposed rolls, each roll being spindle-driven and adjustable. The tubing is 10 per cent nickel silver, with a 0.021-inch wall.



Corrugated-steel construction of trailer side walls at the Fruehauf Trailer Co., Detroit, Mich., is obtained by resistance welding. The equipment is a special Link welder. Before starting to weld, entire side wall is pre-assembled on the table of the machine.

Thickness of metal strip rolled at the Somers Brass Co., Waterbury, Conn., is checked and controlled by an Accu-Ray gage. Upon emerging from the mill, the strip is scanned by the gage. Deviations in thickness as small as 1 per cent can be detected and corrected automatically.



How Solar Machines Jet-Engine Weldments

Outer combustion-chamber casings for jet engines are being completely machined in two chuckings on vertical turret lathes. Substantial increases in output rates have resulted from the autonomous production cycles performed by these machines.

By Robert B. Ballard, Manager
Production Division, Solar Aircraft Co.
Des Moines, Iowa

AUTOMATIC, multiple machining operations requiring only two chuckings are reducing the cost of finishing outer combustion-chamber casings for J-57 jet engines. Representing a complicated machining job, each casing requires more than 125 automatically controlled machine functions.

The casing is of welded construction, being fabricated from Type 410 stainless steel having a hardness ranging from 25 to 33 Rockwell B. Complete machining of this component is performed on Man-Au-Trol equipped, Model 75 Bullard vertical turret lathes, Fig. 1, that have been installed recently at the Wakonda plant of the Solar Aircraft Co., Des Moines, Iowa. Some of the operations being performed in one setup are boring, counterboring, facing, back-facing, turning, and angle cutting. A floor-to-floor time ranging from forty to forty-five minutes is required to machine each end of the casing.

Of the 125 automatically controlled functions taking place during each cycle of the machine, forty-two are performed by the turret-head, forty-three by the side-head, and forty by the ram-head.

A cylindrical fixture is located on the machine table to receive the weldment. The work-piece is held in place by eight clamping blocks that are mounted on the fixture flange and grip the unmachined periphery of the part. This holding arrangement can be seen in Fig. 1.

The machining cycle is initiated when the ram-head moves into position above the fixture and feeds down into the weldment. A roughing cut (0.075 inch deep) is taken across the narrow inside face of the bottom flange, Fig. 2. Following

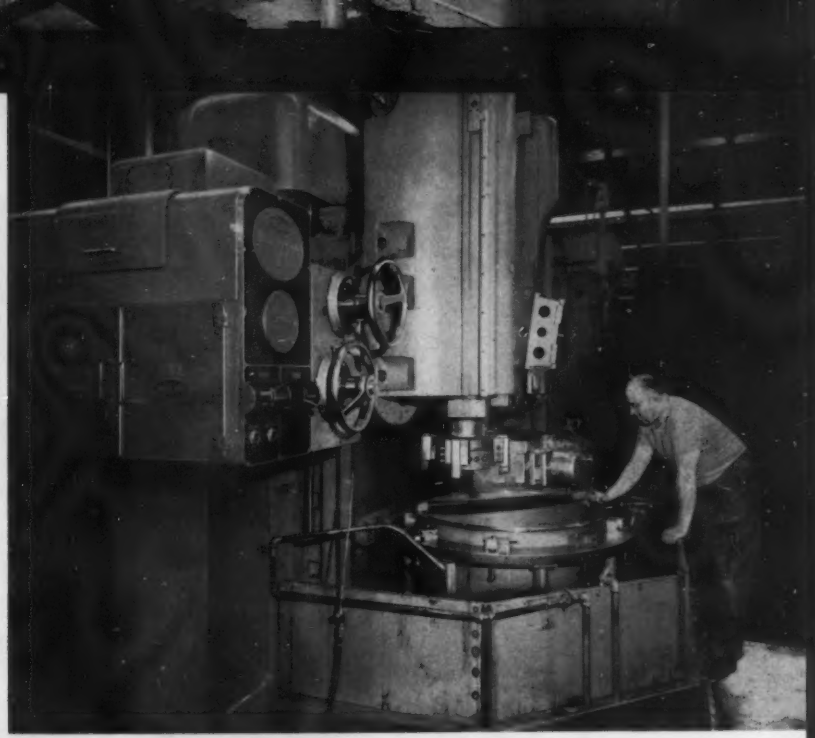


Fig. 1. (Right) Welded outer combustion-chamber casing for jet engine is locked in a holding fixture on the table of an automatic vertical turret lathe.

Fig. 2. (Left) The ram-head of the vertical turret lathe is shown being lowered into the weldment to rough-machine the narrow inside face of a bottom flange.

Fig. 3. (Right) Taking a 0.120-inch deep roughing cut on the periphery of the upper flange. For this operation the side-head of the machine is employed.

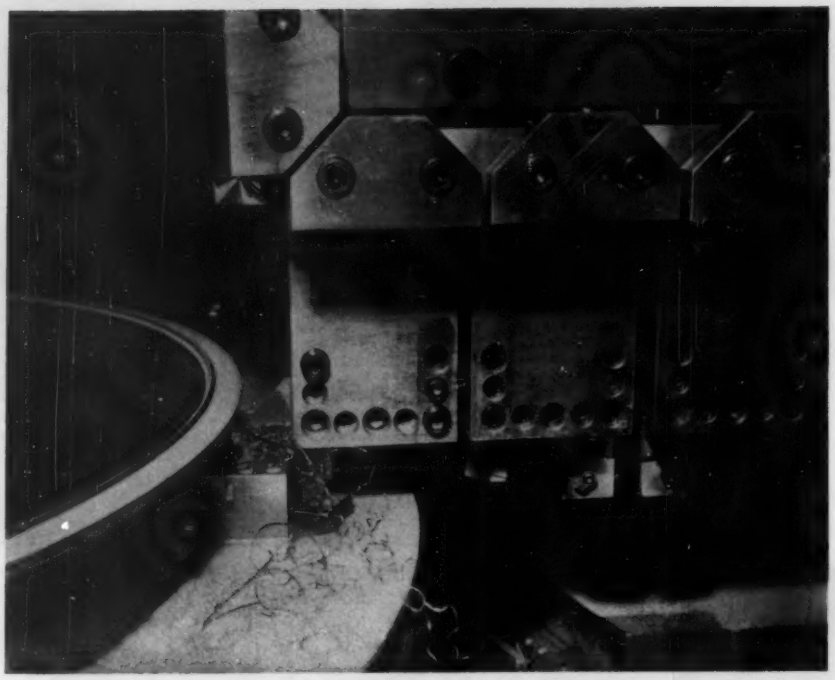
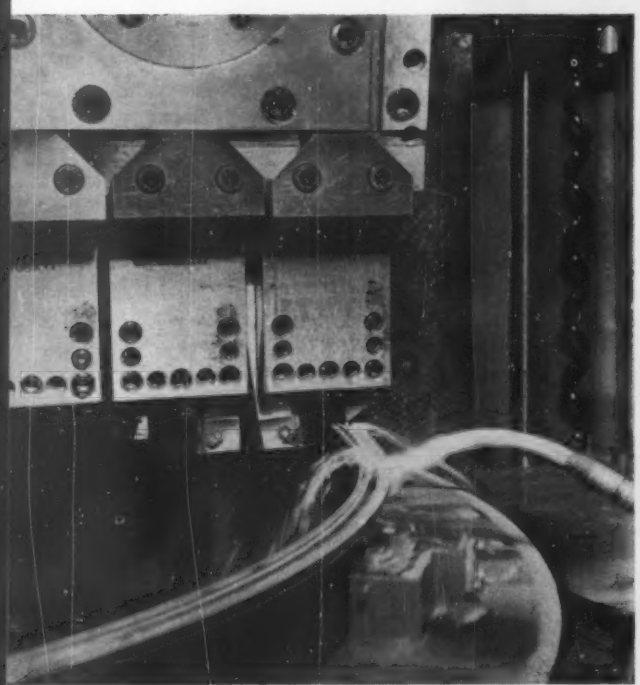


Fig. 4. The first of five tools set up on the turret-head is shown taking a finishing cut across the back face of the upper flange of the weldment.

this, a second roughing cut is taken that is 0.100 inch deep. As the ram is withdrawn from the work, it takes a 0.010-inch deep finishing cut along the inside diameter of the lower flange. After re-entering the weldment, the ram makes a final pass across the inside face of the flange, taking a 0.010-inch deep finishing cut.

As the side-head approaches the work, it takes a roughing cut 0.120 inch deep on the periphery of the upper flange, as shown in Fig. 3. During the rough-cutting operations, the machine table turns at a speed of 52 R.P.M., and the head is fed in at a rate of 0.008 inch per revolution. The tool is then brought up and fed across the flange face taking a 0.100-inch deep cut. After indexing the side-head turret, it again rough-cuts the flange face. During this pass of the tool, 0.150 inch of the metal is removed.



At this time, the ram-head begins to function once more. It takes two roughing cuts on the bore of the upper flange; one cut being 0.100 inch deep and the other being 0.070 inch deep. The ram-head then moves to the outside of the part and takes a 0.060-inch roughing cut across the back face of the flange.

When the back-facing cut is completed, the turret-head, which is set up with five cutting tools, descends. Tool No. 1 finish-machines the back face of the flange, Fig. 4, while the machine table rotates at a speed of 63 R.P.M. The remaining tools finish the flange periphery, flange face, and flange bore. A groove is also cut in the face of the flange, Fig. 5. The weldment is then removed from the fixture, turned end-for-end, and set up on another vertical turret lathe for machining the second flange.

Fig. 5. The last of the five tools mounted on the turret-head can be seen cutting a V-shaped groove in the upper flange face.

MACHINERY'S Reference Section

October 1956

CLEANING METAL PARTS WITH DETERGENTS

By
F. A. SCHNITZLER and A. T. THIBADEAU
Oakite Products, Inc.
New York City

To the uninitiated, the selection of the proper detergent and the appropriate method for cleaning parts could be a difficult job. This article simplifies one phase of the problem by recommending how detergents should be employed.

An electrocleaning stage is incorporated in this automatic plating machine. Parts are loaded into a Lucite barrel and rotated in a heated detergent.

Cleaning Metal Parts with Detergents

By F. A. SCHNITZLER and A. T. THIBADEAU
Oakite Products, Inc., New York City

IN almost every plant manufacturing metal products, soil must be removed from parts after fabrication. Forging, stamping, extruding, grinding, and machining, for example, expose metal work-pieces to such soils as machine oils, rust preventatives, metal residues, and special cutting compounds. The extent and type of soil as well as subsequent operations determine the degree of cleanliness required and have some influence on the cleaning method employed.

Detergents are commonly used in five ways for parts cleaning. The work may be sprayed in a washing machine, soaked in a tank, electrocleaned, barrel cleaned, or—a recent development—sonic cleaned. In contrast to these five methods, there are today probably five thousand products that may be used with varying degrees of success.

The cleaning agent used will depend upon a number of factors that vary from job to job. Among these are: the method of applying the cleaning material; the kind of metal from which the part is made; and the variety and amount of the soil deposits. A major consideration in approaching a solution to any parts-cleaning problem is how the soil and the cleaning solution are to be brought together. While the most basic way is to wipe the cleaning medium on, the obvious disadvantage to this method is that it is slow.

Tank Cleaning Has Many Applications

Probably the most widely used parts-cleaning method is tank immersion. Soiled parts are soaked in a cleaning solution contained in a tank, as

shown in Fig. 1. Such tanks may vary from specially built, thousand-gallon-and-more capacity units, complete with heating coils, facilities for agitating the solution, and overhead hoists, to discarded drums in which only a few gallons of solution is held temporarily.

Determining factors in the design and construction of a tank are: the quantity of parts to be cleaned, the frequency of the operation, and the size and shape of the parts. When cleaning is a critical part of production, it is better to build the tank especially for the job. Tanks such as the one shown in Fig. 2 should be of sufficient size to handle the largest piece of work generally cleaned. While this may seem obvious, it is often overlooked. Also, planning for future production is better than providing just for present needs. On the other hand, if large pieces are not generally handled, it may not be practical to build a tank to accommodate them. Occasional large pieces can be steam-cleaned or swabbed by hand.

Another factor to be considered is the composition of the tank. Alkaline cleaning solutions are best used in a welded black-iron tank. Acidic solutions, on the other hand, should be applied in a container made of long-leaf yellow pine, stoneware, stainless steel, or Monel metal. Tanks should be built to take the punishing blows of work going in and out and the lips made of heavy angle iron to prevent distortion.

While the tank may be heated in a number of ways—by steam, oil, gas, or electricity—selection of any particular medium will depend largely upon cost and availability. If a plant has its own steam supply, for instance, steam may be a wise selection, provided the boiler is operated throughout the year. With steam available, the cost to run lines to the tank should be less than to bring in a gas line from outside.

Steam coils are recommended in preference to an open steam line because condensate from the latter will dilute the cleaning solution. The coils should, of course, be made of materials compatible with the fluids involved. Iron or steel tubing is used for alkaline solutions, while Pyrex, graphite, or impervious carbon is favored for acidic solutions. The length of the steam coil will depend upon the capacity of the tank; the diameter of the coil, which should rarely be less than 1 inch; the steam pressure available; and the time in which the proper temperature should be reached.

If oil or gas is selected as the heating medium, an open flame should be applied directly against the bottom of the tank. In this way, the burners are easily accessible for adjustment and cleaning. A number of small burners is better than one large one, since the heat is distributed more evenly, and only those burners necessary to maintain the temperature need be kept burning.

Another method of applying oil or gas heat is through a tube immersed in the solution. This method is efficient, but the tubes, being large and bulky, take up valuable space. Also, the high flame temperatures tend to produce scale, which limits heat transfer.

Heating the tank by electricity is relatively expensive. The best method of application is by electrical resistance elements, encased in protective jackets and immersed in the solution. Strip forms of the same type of element may also be fastened to the exterior of the tank, but this is obviously less efficient.

Coils, pipes, or electrical elements should be easily removable from the tank. These heating devices should not be placed at the bottom, where scale or sludge might reduce their efficiency. Here they would be subject to damage when the sludge

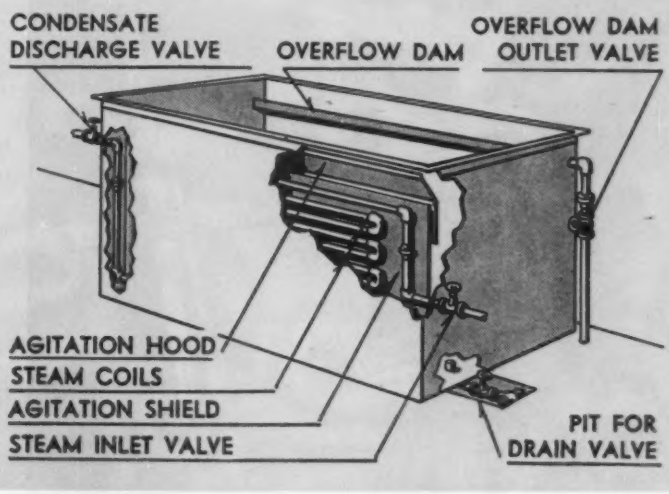


Fig. 1. A typical tank used for cleaning parts with heated detergents. The overflow dam permits skimming off contaminating soils.

Fig. 2. A large cabinet is removed after being cleaned in this 1100-gallon tank. A conveyor moves the shell from tank to tank.

is shoveled out. A properly installed Tranter Platecoil heating element is illustrated in Fig. 3. Agitation of the solution increases the rate of cleaning. It can be produced by convective circulation directed by baffles or shields or mechanically by such devices as revolving paddles. Drainage, too, is important. To avoid rapid contamination of the solution, there should be a surface drain to permit skimming off the grease and oil and a bottom drain for dumping the solution.

For maximum efficiency, it is recommended that thermostatic controls be installed to keep solution temperatures within the proper operating range. Insulating the exterior of the tank will reduce heat loss. An overhead hoist facilitates the handling of heavy work.

Electrocleaning—Agitation Occurs at Surface of Work

Electrocleaning is a must before plating. It is simply tank cleaning but with a special kind of agitation added to speed removal of the soil.

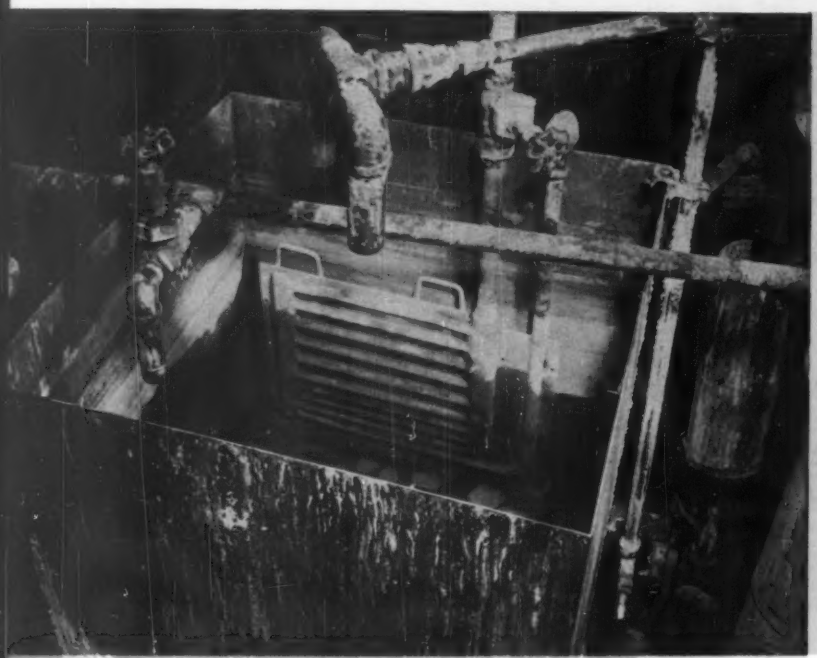


Fig. 3. Heating elements are easily accessible when installed at the side of the tank. Here, they are less liable to loading damage and sludge build-up.

Passing current through the solution causes the water to decompose into hydrogen and oxygen gas. The outward sign of this breaking down of the water is a bubbling action. As the bubbles move upward, they agitate and circulate the solution, thereby increasing its cleaning ability. Without this agitation, the solution within the immediate vicinity of the work would become contaminated and, thus, slow the cleaning action. With the solution in motion, a fresh portion is always coming into direct contact with the work. Faster cleaning and longer solution life result. The heading illustration shows an electrocleaning stage for steel and brass work-pieces used as part of an automatic plating operation at the Spectranome Plating Co., New York City.

Reverse-current, or anodic, cleaning is recommended for cleaning steel rather than direct, or cathodic cleaning. Reverse current actually removes the soils from the steel electrolytically. This prevents hydrogen occlusion and embrittlement and makes the steel more tolerant of chromic acid. Parts such as those shown in Fig. 4 are reverse-current cleaned before plating. Direct current is recommended, however, for the electrocleaning of high-nickel alloys or leaded brass. Both direct- and reverse-current cleaning can be used when cleaning must be of high quality. Reverse current electrically removes the soils which may have been deposited on the work by direct-current action. Fig. 5 illustrates an automatic reverse-current electrocleaning stage at the Gilton Mfg. Co., Brooklyn, N. Y.

Precleaning is generally recommended when electrocleaning, in order to protect the latter solution from contamination by cutting oil, metal chips, or shop dirt. It often makes the difference between high and low reject rates and between costly and economical electrocleaning. Precleaning is done in a still tank, in a spray washing machine, or by preliminary reverse-current cleaning. To protect the electrocleaning solution from premature contamination, two tanks should always be used. Careful control of voltage, current density, and immersion time is important.

As it is in any cleaning process, rinsing, using immersion and spray methods, is very necessary in electrocleaning. The rinse tank should be provided with a constant flow of fresh water and adapted to overflow all surface contamination. Agitating the rinse tank with compressed air is also helpful.

The importance of rinsing is emphasized by the fact that products have been developed for use in the rinsing stage only. One such material, used at concentrations of 1/2 to 1 per cent by volume, prevents water spotting and retards rust between finishing operations. Used after plating, it protects the bright metal finish. It is particularly effective where hard water is used for rinsing.

Barrel Cleaning for Moderately Soiled Parts

Barrel cleaning is still another form of tank cleaning. Agitation is provided by the rotation of the barrel. This method is ideal when parts are not too heavily soiled, as in the case of zinc die castings, aluminum sand castings, steel and brass screws, nuts, bolts, and eyelets. Since barrel cleaning is a large-volume process, individual inspection of the cleaned parts is impossible. It is essential that the detergent be carefully selected to insure complete cleaning and free rinsing. This method is frequently used prior to burnishing, barrel plating, and lacquering. A typical barrel-cleaning operation is illustrated in Fig. 6.

While both cleaning and tumbling are done in similar barrels, the same barrel should not be

Fig. 4. Musical-instrument parts made of steel are inspected after electrocleaning. Reverse-current cleaning prepares the parts for plating.

used for both operations. Soil removed in the cleaning operation might contaminate the burnishing solution.

Machine Cleaning—the Assembly Line Method

Where metal parts must be washed in large quantities, on an assembly line basis, washing by machine is recommended. It is the fastest possible cleaning process, combining the mechanical force of spray jets or paddle wheels with the chemical and physical action of the cleaning solution. Such a machine, employed by the Saco-Lowell Shops, Biddeford, Me., is shown in Fig. 7.

While standard machines are often adequate or easily modified, it may be desirable to have the machine engineered to fit the job. Special production problems are presented by size and volume of parts, time allotted for cleaning, and subsequent operations. Many machines provide for more than one washing stage, rinsing, and forced drying. Provision for applying a phosphate prepaint treatment is often incorporated. The time during which the soiled part is exposed to the detergent solution in the washing machine is generally limited to less than one minute. Sometimes it is of no more than fifteen seconds duration.

Machines used for removing heavy soils frequently have two washing stages. The first will remove most of the soil and warm up the parts. The second cleaning stage can then be operated at the best temperature and efficiency and thus rinse the soil more completely from the work. Some units include compartments in which the parts are progressively washed, rinsed, pickled, rinsed, neutralized, rinsed again, dried, and finally given an anti-rust treatment.

Today's washing machines use several means for moving the parts through the various stages. Either a flat conveyor belt, an overhead monorail, or a screw-like drum is employed to transport the work. In spray machines, the solution is delivered through fixed nozzles which cover the work from all angles as it passes. Some machines do not use sprays at all. One type uses a paddle wheel to splash the solution on, while another machine combines mechanical tumbling with immersion washing.

The operation of a typical spray washing machine is shown diagrammatically in Fig. 8. Pump *A* forces the solution from tank *B*, through the spray jets in area *C*, to clean the parts located on conveyor *D*. The solution then drains from the work back into the tank, where the emulsified oil and grease are skimmed off at *E*. Solid chips and soil particles are filtered out by screens *F*. The solution is then drawn back to the pump, through suction line *G*, and recirculated. The spray jets are sensitive. If they are not the proper size, or if they are not properly placed, the machine will not do the job. Also, the orifices in the spray nozzles should be designed so as not to clog easily.

The pump should be able to deliver the correct volume of solution at the required head pressure. The volume, however, should not be great enough to cause the solution to recirculate too rapidly. This would cause too much foaming and prevent the settling out of insoluble soils. The unit should, of course, be designed for use with either the acidic or alkaline solution being used.

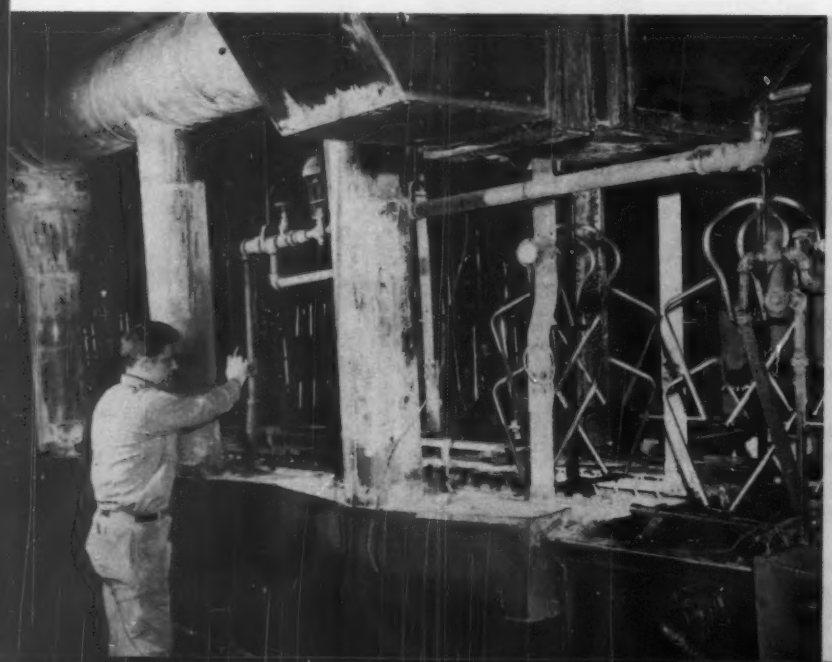


Fig. 5. The electrocleaning stage, here shown, has a foam blanket that keeps alkaline spray from rising.

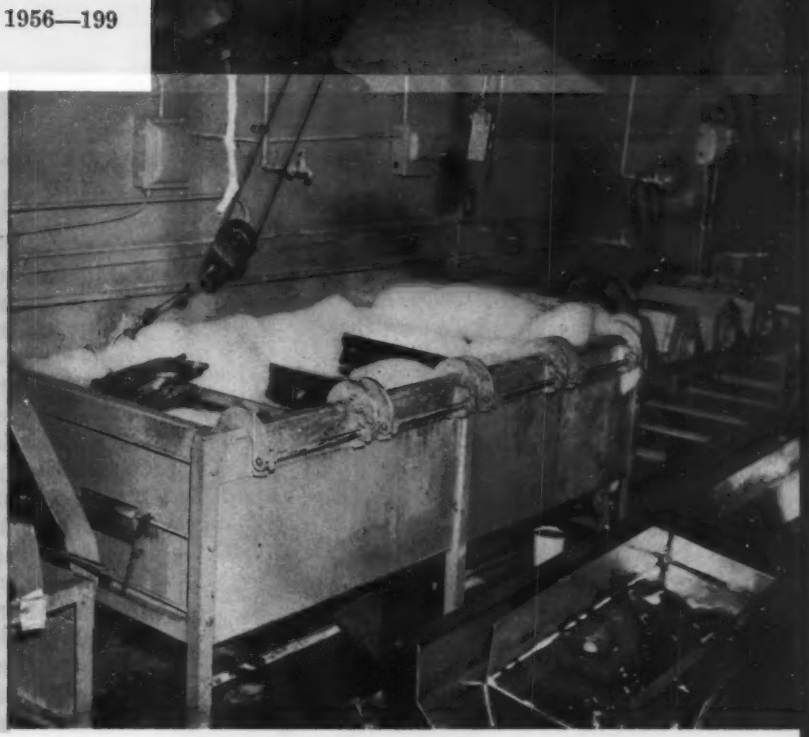


Fig. 6. Light and small parts that are not too heavily soiled may be satisfactorily cleaned in barrels. The detergent compound should be selected for free-rinsing properties to insure thorough cleaning.

Before a machine is selected or designed for any production line, these factors should be considered: (1) the floor space which the machine will occupy; (2) the heat necessary to keep the solution and rinsing mediums at the proper temperatures; (3) the amount of water which will be used; (4) the power needed to operate the conveyor and to pump solution and rinse water; and (5) the labor required to operate and maintain the machine.

Sonic Cleaning Has Special Applications

Sonic cleaning shows great promise for the future. Basically, this method is a type of tank cleaning that uses electrical energy converted into sound waves to vibrate and agitate the solution. It has been proved effective for large-volume cleaning of small parts, such as pen points and electric shaver heads. Sonic cleaning does an excellent job of removing soils from tiny crevices. The method is expensive, however, and requires more development before it can be considered practical for cleaning large parts.

Specialized Detergents Are Most Effective and Economical

Many substances, including water as it comes from the tap, will clean. The distinction between cleaning substances is in the *degree* of cleaning they offer. The safest, fastest, and most thorough cleaning is accomplished when specialized and compounded detergents are employed. The type ideally suited to the job at hand is the most economical in the long run.

Chemical cleaning materials are divided primarily into three general classifications: alkaline, acidic, and solvent detergents. All three types are suited to parts cleaning. The choice of cleaner depends upon the method by which it is applied and the type of metal on which it is particularly effective.

Because of their flexibility, alkaline cleaners are very popular for use in tank, barrel, and spray washers. Usually, this type of detergent comes in powder form, the powder being dissolved in water prior to use. Working concentrations will range from less than 1 ounce per gallon of water up to 12 to 14 ounces per gallon, depending upon the soil and the method of application.

In most cases, alkaline solutions are used hot. Such cleaners vary in the degree of alkalinity compounded into them. The heavy-duty types have a higher reading on the pH scale. Those designed for cleaning aluminum parts have special inhibitors added to preserve the work surface. The inhibitor forms a shield over the clean aluminum, protecting it from the free alkali in the detergent. Solutions compounded with inhibitors for safe use on aluminum will not clean quite as fast as the heavy-duty cleaners employed on steel parts.

Most alkaline cleaners are used to remove deposits of oil and grease, although a new type has recently been introduced which also removes rust, heat scale, and phosphate coatings, as well as ordinary soils. It is particularly useful in preserving the dimensions of precision parts and where hydrogen embrittlement must be avoided.

Of the three types of cleaners, those of the alkaline family are usually the least expensive. However, there are some cases where they are not applicable.

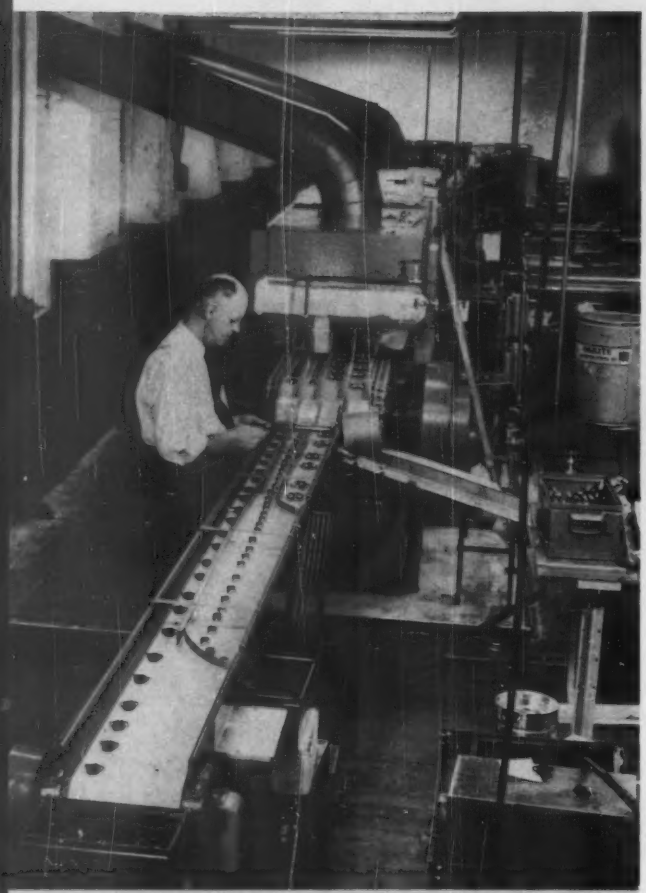


Fig. 7. Parts are cleaned and given a rust-preventive rinse in this washing machine. Specially formulated detergent has low foaming properties.

On some cleaning jobs, the heat needed to keep an alkaline solution at proper working temperature is not available. In that case, a solvent type detergent that does its cleaning at room temperature is needed. The cleaning action of this type of detergent is different from that of alkaline cleaners.

The particles of oil, contained in most soils, bind them to the part surface. Solvent detergents attack these oil binders with surface-active agents containing molecules that can attach themselves to both oil and water. These so-called double-ended molecules are said to have both oil- and water-loving ends. The oil-loving ends immediately attach themselves to the oily particles in soil. On rinsing, the water-loving ends of these solvent detergent molecules attach to the moving water and physically carry the soil away from the part being cleaned.

Due to their method of dealing with soil, solvent type detergents are particularly suited to the removal of extra-heavy carbonized grease and oil. Such deposits are left on parts by buffing compounds, drawing and stamping compounds, cutting and grinding lubricants, mill and slushing oil, and rust preventatives.

Where parts are very heavily soiled, solvent detergents are frequently used as precleaners before running the work through the regular alkaline solution. The heavy surface soil is removed before the part enters the alkaline tank, thereby prolonging the life of that solution. In this way cleaning is speeded. The use of the second cleaning stage actually saves money too, by requiring less frequent dumping of the alkaline tank.

Solvent type detergents are widely used in spray washing machines. They come in liquid form and in many cases are diluted with water or a petroleum distillate. If water-mixed solvent detergents are used, the threat of fire, normally associated with solvents, is avoided. In addition to their cleaning ability, these detergents provide metal parts with a degree of protection against corrosion. This is an advantage during temporary storage.

Separate and distinct from both the alkaline and solvent detergent are the acid type cleaners. These are usually employed to remove oxide and heat scale. Some acidic cleaners remove grease and rust in one operation and, at the same time, etch and treat the metal surface to improve paint adhesion. Phosphate treatment, while related to parts cleaning, is a specialized subject—beyond the scope of this article.

Acid cleaners are often used in barrel cleaning to remove heat scale and rust from ferrous metals. Some come in powder form and, like the alkaline cleaners, are dissolved in water, a few ounces to the gallon. Others come in liquid form and are either used straight or diluted with water. The concentrations range between five and fifty per cent by volume.

In spite of the fact that they may appear similar, no two parts-cleaning operations are exactly the same. Slight differences in soil, metal, shape of part, storage conditions, and production cycles can mean major changes in the cleaning operation. But fundamental methods and materials, as described, remain the same. The difference is in the way they are used.

For example, here are three typical parts-cleaning operations as they are actually handled in industry today.

Example 1

PROBLEM: To remove drawing compound from aluminum cups and shell liners prior to buffing and anodizing.

METHOD: A six-stage pressure-spray washing machine is employed. This machine was specially built in the plant where it is used. The cycle is as follows: In the first stage, a specialized alkaline detergent, Oakite Composition No. 161, designed for spray-washer application to aluminum, is applied. The detergent is diluted with water at a rate of 2 ounces per gallon. Temperature of the solution on application is 180 degrees F. In the second stage, this operation is repeated. The only exception is that the concentration of the detergent solution is reduced to 1 ounce per gallon. The third and fourth stages, being cold rinses, are followed by a hot rinse in the fifth stage.

Example 2

PROBLEM: To clean various tractor parts and protect them temporarily against corrosion prior to inspection.

METHOD: A number of single-stage washing machines are used. Each is charged with Oakite Composition No. 21, 1 ounce per gallon of water. The solution is heated to 170 degrees F., and the parts are left in the washing machines about one minute. Cleaning results are good, and the parts resist corrosion.

Example 3

PROBLEM: To remove shop soil, drawing compound, and metal chips from terneplate auto radio chassis parts.

METHOD: Three tanks are used. The first contains a 5 ounce per gallon solution of Oakite Composition No. 23, held at 170 degrees F. Parts are immersed in this cleaning stage for five minutes. They then pass to the second tank for a running-water rinse. Finally the work-pieces are immersed for two minutes in the third tank, which contains a 1/4 per cent by volume concentration of Oakite Composition No. 97, at 200 to 212 degrees F. The latter solution helps prevent water spotting and protects the parts against rusting during shipment to assembly plants.

These typical cleaning situations point up the importance of using the right detergent for each particular job to be done. In this connection, the services of a cleaning specialist can be invaluable in planning a parts-cleaning operation.

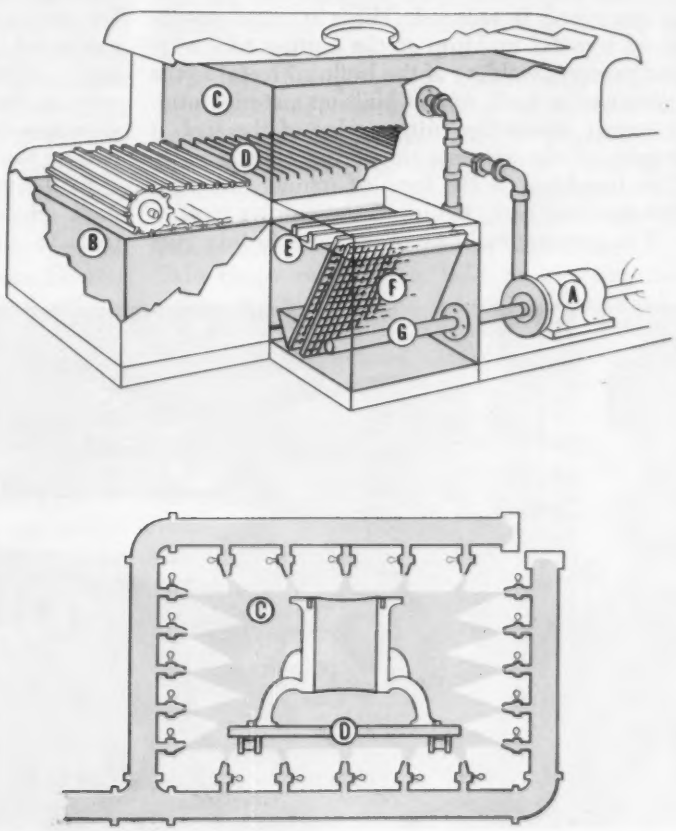


Fig. 8. A typical spray washing machine (top) that is employed in many production lines. Parts are sprayed while traveling through machine, as seen in the cross-section view at bottom.

Cemented Oxides or Carbides?

Both are needed for cutting speeds from 0 to 3000 feet per minute

By H. J. SIEKMANN
Engineer in Charge—Machinability Laboratory
Metallurgical Products Department
General Electric Co.
Detroit, Mich.

Although carbides have solved an increasing number of machining problems during the past ten years, their successful application in two areas —cuts below 100 and over 1000 feet per minute— has been, in most cases, impossible. The principal reason for the poor results in the high-speed area is attributed to the terrific heat generated, causing even carbides with their high red hardness to fail at the cutting edge.

When machining steel, cutting forces increase as the speed is reduced. These reduced speeds cause a metal build-up at the cutting tool edge and pressure welding of the built-up metal to the cutting edge itself. As this built-up material intermittently leaves the cutting edge of the tool, it breaks off the extreme tip of the cutting edge. This breakage, in the form of minute chipping, brings about early failure of the cutting tools.

The seeming inability of carbides to take cuts on soft and medium-hard steels at slow speeds has limited the use of carbide cut-off tools and the more widespread use of this cutting-tool material for other applications. It also has discouraged the use of carbides for facing large-diameter pieces, where the cutting speed decreases as the tool approaches dead center. Also, in instances where the speed is limited due to the exceptional large size of the parts, or when it is necessary to use large swing lathes or old machine tools having low maximum speeds, carbides have not been too successful. However, it has been necessary to apply carbides at low speeds on operations involving the machining of harder steels, where slow speeds must be used due to the difficulty in cutting the material.

In the past, the only way carbides could be used effectively was to redesign the machine tools to obtain the desired higher speeds. The

Fig. 1. Carbide tool being used on a new type planer having high table speeds. A 1/2-inch cut is being taken at 180 feet per minute on this 2000-pound casting.

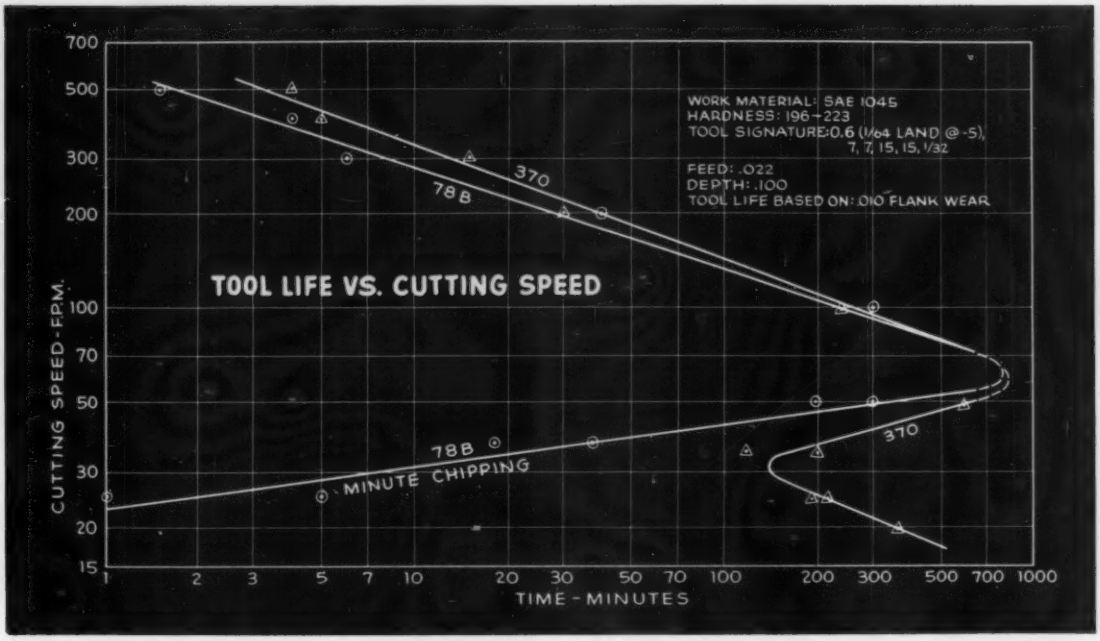


Fig. 2. Effect on tool life of two different carbide materials is shown here, when used at speeds below 60 to 70 feet per minute.

recent application of carbides to planers, for example, is due chiefly to the higher table speeds available. Planer work usually involves large work-pieces and long cuts through inclusions and surface irregularities of the metal which produce terrific heat at the cutting tool. Until faster table speeds became available, high-speed steel cutting tools were operated at low speeds to avoid tool failure and excessive machine down time for regrinding. On one specific planing job, Fig. 1, the availability of faster table speeds and the application of carbides trimmed down a thirteen-hour job on a single part to less than seven hours. Cutting speed was increased from 40 to between 160 and 180 feet per minute.

The devastating effect on a commonly used steel-cutting type carbide, as speed is reduced below 80 feet per minute, is illustrated in Fig. 2. Until recently, this is what could be expected. The tensile stresses applied to the carbide cutting edge, as the welded built-up edge breaks off, are resisted by the new tougher, stronger grades of carbide, and good tool life is obtained at speeds down to zero. The effect of these improved carbides in reducing the coefficient of friction (sliding force divided by normal force) is shown in Fig. 3.

Tool geometry plays an important role when carbide tools are operated at low speeds. Forces increase rapidly below 200 feet per minute on tools having side-rake angles of 6 degrees positive or 5 degrees negative. However, the cutting force drops down as the speed is reduced below 100 feet per minute on tools having a negative side rake of 5 degrees, as seen in Fig. 4. All three cutting forces for this negative rake tool are shown, in greater detail, in Fig. 5.

Today, through proper tool design and the availability of superior grades of carbides and cemented oxides, the machining horizon has been extended in two directions—down to 0 and up to 3000 feet per minute. Fig. 6 illustrates what can be done by teaming up carbides like Grade 370 and cemented oxides similar to 0-30. Here, a carbide throw-away tip is held in a mechanical holder and plunged into the center of the work—an AISI 6145 steel blank, 12 inches in diameter. The tool is fed outward until a speed of 600 feet per minute is reached. At that point, the tool is changed through use of a quick-indexing square turret, to bring into action a cemented oxide tool which is fed outward until a maximum speed of 2600 feet per minute is attained at the outside diameter of the work-pieces. The total time required for the cut is under 1 minute—33 minutes less than that required with previous tooling. Depth of cut is 1/16 inch, and a feed of 0.0115 inch per revolution is employed. The cemented oxide tool produces a mirror-like surface finish. This application illustrates that the greatest benefit of these newly developed tool materials can be obtained by applying carbides in the carbide range and cemented oxide in the high-speed range.

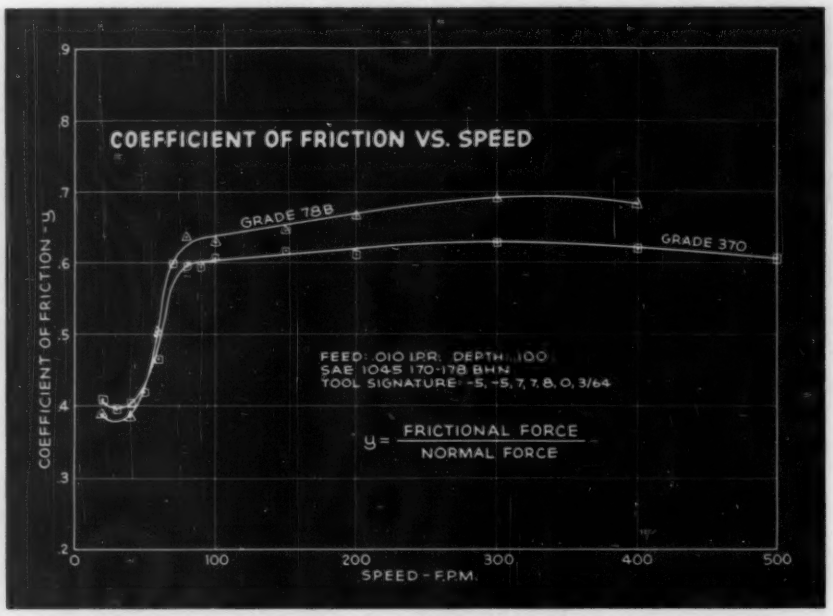


Fig. 3. The coefficient of friction for newly developed steel-cutting grade carbides is lower than that for older types.

In low-speed production jobs such as the bomb plug seen in Fig. 7, cutting to dead center can be handled with carbides. Previous attempts to use carbides in machining this 1 7/8-inch diameter part proved unsuccessful. The job involved threading the outside diameter of the AISI 4140 steel forging, having a hardness of 180 Brinell, and facing the end to dead center at the same time. Two factors solved the machining problem. One was in applying a superior grade of carbide, in this case 370. The other was the use of a tool geometry having a free-cutting, positive side rake of 6 degrees. Also, the shape allows the cutting edge to be strengthened through the use of a negative land of 5 degrees and a honed edge.

The work was turned with the periphery of the part traveling at a surface speed of 40 feet per minute. A feed of 0.015 inch was used, with the depth of cut set at 1/8 inch. Although the finished surface of the work-piece was rough, due to the extremely low speed, the carbide tool showed very little wear. A modified standard brazed type tool was employed in this application with no coolant.

In the past, cast nodular and malleable iron crankshafts have been machined by carbides with good results. However, until recently, topping, cheeking, and turning of the bearing and connecting pin surfaces on cast and forged steel crankshafts with carbides proved difficult. Today,

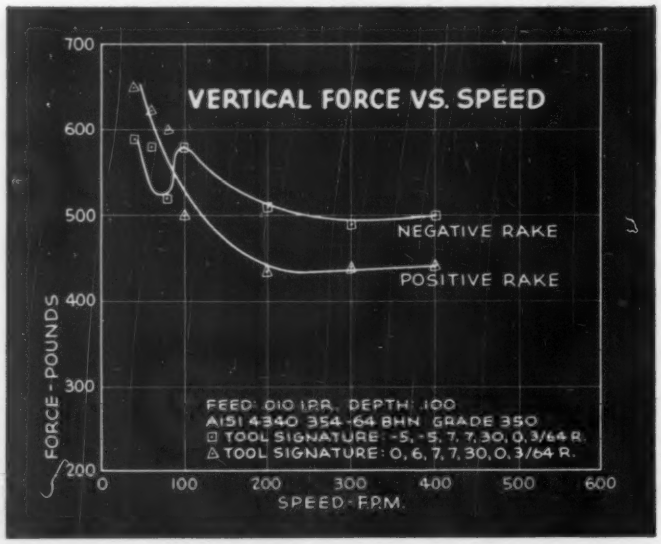


Fig. 4. Vertical force for negative side-rake tools is generally higher, but drops at speeds below 100 feet per minute.

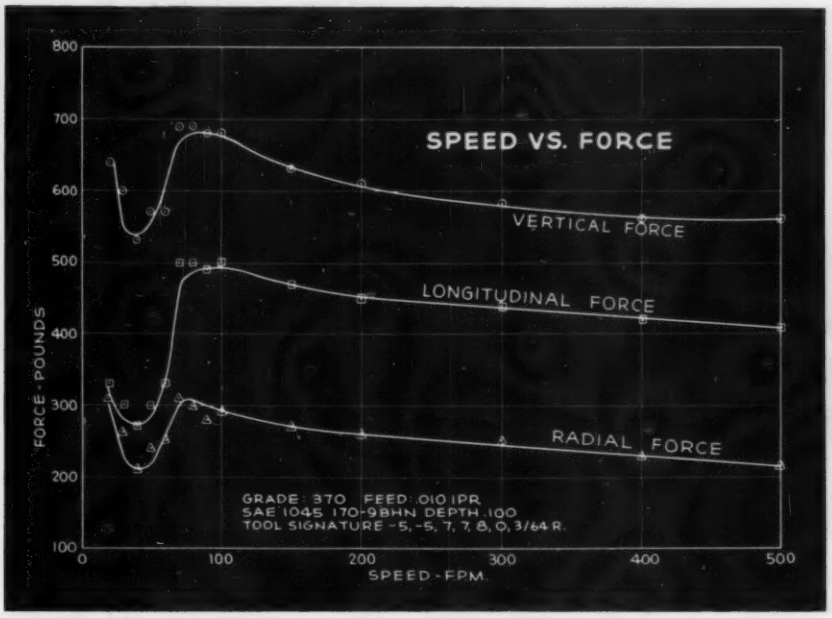


Fig. 5. Graph showing details of the cutting forces at lower speeds on tools having a negative side rake of 5 degrees.

the machining of crankshafts at low speeds with cemented carbides is not only feasible but is also economical production-wise. Proper tool geometry is the secret of low-speed machining. This, coupled with honing of the cutting edges, provides such good tool life that it is entirely possible to use machining speeds for such operations as low as 60 to 70 feet per minute.

Of the three different types of crankshaft materials, forged steel proved the most difficult to machine. Good tool life, however, was obtained with a throw-away-insert type tool-holder providing a negative rake angle of 5 degrees. Also, cutting edges were honed at 45 degrees to produce a 1/64-inch land. The carbide used (Grade 370) produced over twice the tool life previously obtained under low-speed cutting conditions.

Tool life on cast-steel crankshafts was even better, using the same grade of carbide. The malleable cast-iron crankshafts machined similar to ductile cast iron, producing a somewhat continuous chip. In this instance, it was found that Grade 883 carbide gave extremely long tool life. During tests, crankshafts were chucked on centers in a 20-inch engine lathe, and interrupted turning cuts were taken along outer extremities of the crankshaft, as seen in Fig. 8. This produced the effect of passing in and out of the scale and gave an interrupted cut similar to that taken when facing cheeks of crankshafts in the perpendicular direction.

At the beginning of the tests, the experience of crankshaft producers was reflected in attempting to use carbides at low speeds. These same speeds, 60 to 70 feet per minute, normally cause the built-up edge to weld to the cutting edge, resulting in failure through chipping. With proper tool geometries, a tool life of over 135 minutes was obtained in the cut, compared to about 35 minutes previously encountered. It was also found that complicated grinding of a land

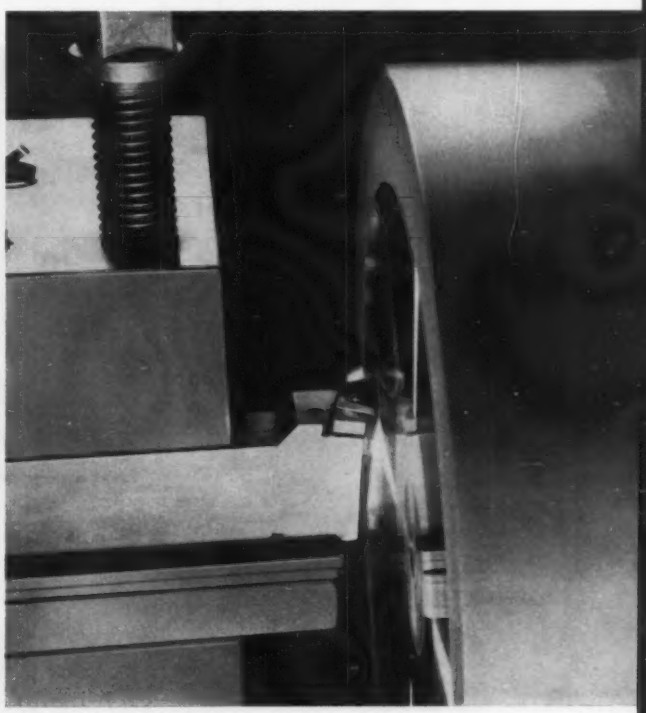


Fig. 6. Both carbide and cemented oxide tools are used to face this steel blank in less than 1 minute. A speed of 0 to 600 feet per minute is used with carbide, and 600 to 2600 feet per minute with cemented oxide.

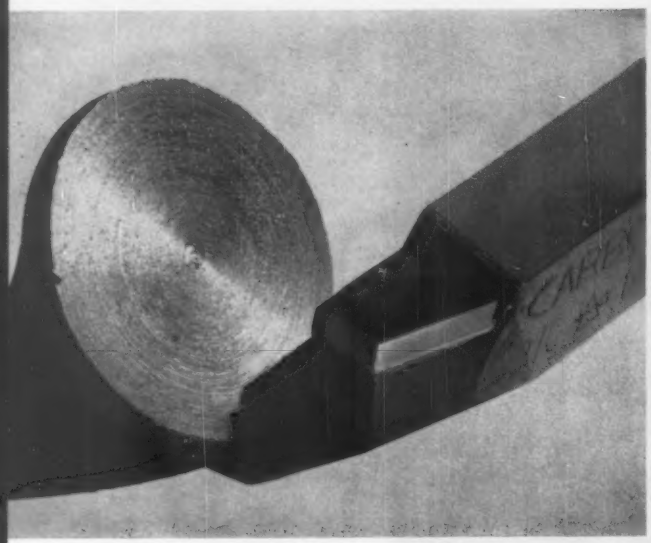


Fig. 7. In taking a facing cut to dead center on this bomb plug at low speed, a rough surface was produced. However, no chipping and little wear on the carbide cutting edge resulted.

could be eliminated by using throw-away-insert tools and honed cutting edges. Grade 370 carbide, throw-away inserts, with back and side rakes of 5 degrees and lands honed to 1/64 inch, provided good tool life.

The malleable iron crankshafts were easy to machine under all conditions. No built-up edge was apparent, and low speeds did not seem to bring about chipping. The test indicated that Grade 883 carbide with no special tool grinding gave the longest tool life.

With the availability of cemented oxide cutting tools, machining at speeds above 1000 feet per minute is now possible. As indicated in Fig. 9, however, there are great differences between the various ceramic type tool materials on the market. Some of these materials have a tool life in the carbide range, and some in the high-speed range. Also, some of the new carbides being introduced by industry seem to operate in the high-speed range rather well.

In reaching for the high-speed side with today's ceramic type tools, one thing is sacrificed—a reduction in material strength. Except for some of the experimental, high-speed range carbides, the strongest ceramic tool material is weaker than the weakest carbide. Carbides will always take a tougher job than ceramics. They are not only tougher but less expensive and will outperform ceramics in the carbide speed range.

A glance at the slopes in Fig. 9—which compares carbides and ceramics in the carbide range in relation to cemented oxide—and by applying a simple formula for arriving at the cheapest production cost, best tool life, and optimum cutting speeds, the following can be found:

$$T = \left[\frac{1}{n} - 1\right] \times \left[\frac{(M \times TCT) + t}{M}\right]$$

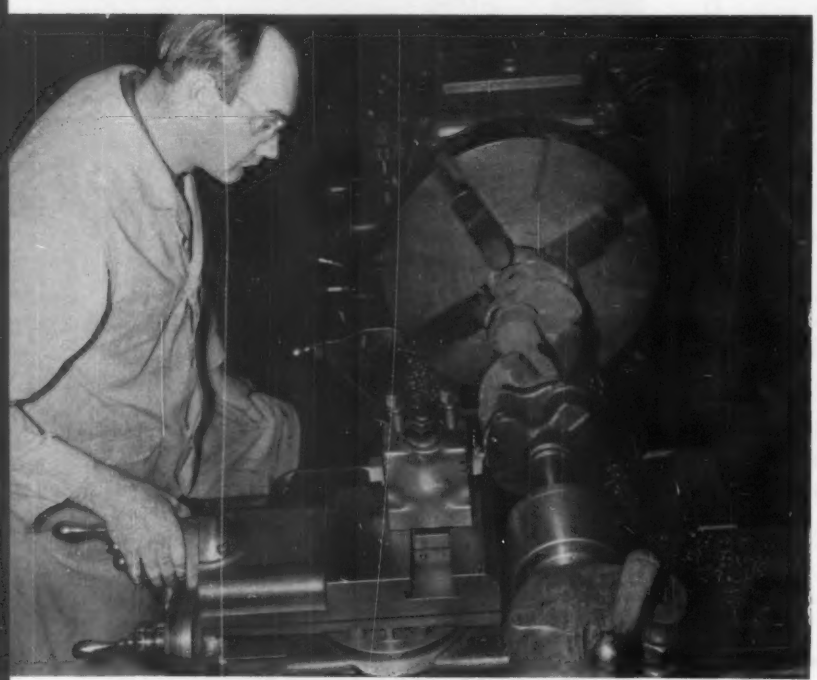


Fig. 8. Interrupted, low-speed test cuts on steel crankshafts were taken at speeds from 60 to 70 feet per minute, with work held between centers.

where T = minimum cost tool life
n = slope of the tool life line
M = machining labor plus overhead cost
TCT = tool changing time
t = tooling cost per sharp cutting edge

Assuming, for purposes of comparison only, that M = $9 per hour ($0.15 per minute), TCT = 4 minutes, and t = $1 per edge, then:
for Grade 350 carbide, where n = 0.25,

$$T = \left[\frac{1}{0.25} - 1\right]\left[\frac{0.15 \times 4 + 1.00}{0.15}\right] = 32 \text{ minutes}$$

From Fig. 9, it is found that the minimum cost cutting speed for this amount of time is 565 feet per minute and, for cemented oxide, Grade 0-30, where n = 0.4,

$$T = \left[\frac{1}{0.4} - 1\right]\left[\frac{0.15 \times 4 + 1.00}{0.15}\right] = 16 \text{ minutes}$$

From Fig. 9, it is found that the minimum cost cutting speed for this period of time is 1800 feet per minute.

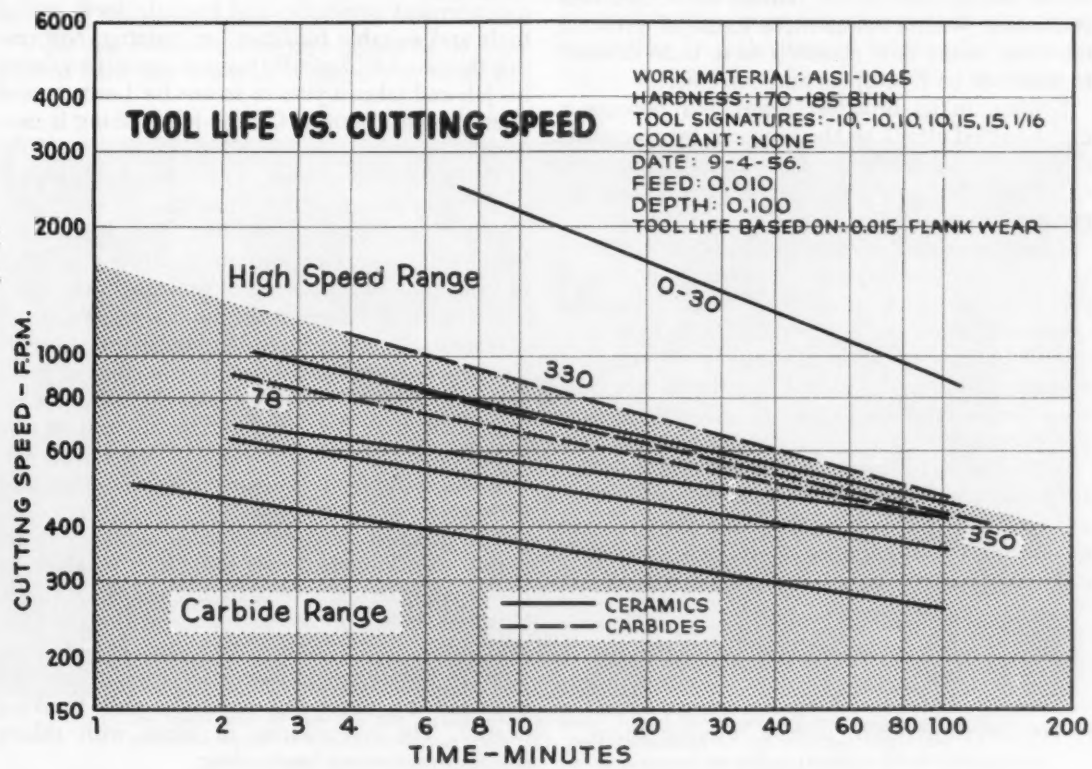
Thus, the optimum speed for cemented oxide is much higher than that for carbides. However, when using such high speeds, available horsepower limits machining to light finishing cuts—since even a 0.010-inch per revolution feed and a 0.100-inch depth of cut, at a speed of 2000 feet per minute, take between 25 and 30 H.P. at the motor.

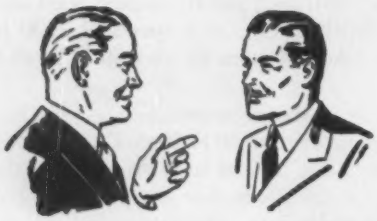
Most plants in the country today do not seem to have much more than 30 H.P. available on high-speed lathes. Also, lack of high strength in these ceramic tool materials makes them more reliable when taking light cuts. Although application of these finishing-tool materials has been limited, they have produced excellent results when properly applied.

On one job, for example, they not only made it possible to average 1800 cuts per tool edge but also slashed cycle time by more than 50 per cent while increasing cutting speed from 450 to 1000 feet per minute. The cemented oxide was applied in the form of throw-away type tools, for cutting AISI 5135 forged steel parts, having a Brinell hardness of 200.

Short tool life does not deter from the advantages of ultra-high speeds of this new tooling material. In one test, cemented oxide removed 70 cubic inches of steel in 1 1/4 minutes at 7500 feet per minute. This would be equivalent to finish-turning 143 inches of bar stock, 1 1/4 inches in diameter.

Fig. 9. Tool life versus cutting speed for various carbide and ceramic type cutting tools show wide variations.





Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

The Sales Manager's Changing Role

A Midwesterner, enjoying the brilliant foliage of Vermont, stopped his car to hail a farmer at work near the road. "Lived here all your life?" he asked. "Not yet" was the reply. The industrial equipment sales manager, too, can well look toward the future, since pronounced changes have occurred in demands since World War II. Since they came gradually, he may easily have escaped their full impact. To do his job well, he must have a broader group of faculties and behavior traits than possessed by the former number-one salesman.

The industrial market has grown in size and complexity. Products and services have vastly multiplied, and to furnish them, processes have become involved and exacting. The rage to substitute mechanization for human effort and skill continues. With a competitive battle of growing intensity, many new channels have been devised to motivate both prospect and customer.

Selling, in its broadest sense, has become a multi-angled attack on the prospect by specialists at home base and in the field. It includes every step from identifying the market to servicing the product sold.

Many sales departments are being reorganized to meet changed demands. Selling, as of old, is just one function of marketing. High up on the corporate organization chart there is now, frequently, a manager of marketing. He is no longer a specialist in making sales, but rather a "general" who directs organized effort to make it easy for prospects to buy.

Irrespective of charts and titles, one question the manager should ask is: "How can I develop my qualities and skills as an administrator?" Let us sketch the attributes of today's successful marketing executive:

He plans well into the future.
He organizes, placing the right man in the right place.
He coordinates and integrates human effort.
He develops men, neither leaving them alone nor stealing their independence.
He inspires men, not by commanding them, but by listening and encouraging.
He studies every logical means of influencing opinion and establishing conviction.
He runs his job—never lets it run him.

Note that not one of the seven items relates only to sales. All relate to management.

The modern marketing manager is much more of a broad-gage businessman than his predecessor. Sights have been lifted. Useful knowledge expanded. New skills put to use. And, above all, there is a more abundant storehouse of wisdom.

In industry there is a shortage of able managers. In marketing fields management talent is harder to find than sales talent. Only during the last few years have we made a serious dent in the study of management principles and brought forth useful tools and suitable facilities for training. Not one in a thousand technically trained executives drops his job and takes a year or so out for business and management training. On-the-job training is necessary.

Three competent sources offer short conference or seminar courses: the American Management Association, the Sales Executive Club, and a number of educational institutions. Such courses benefit from a faculty made up of professors and businessmen. Based largely on discussion, the result of experience is given full play. The "student" receives instructions on sound principles of management. One outstanding benefit, often overlooked, is that the "student" is aroused to the importance of creating within his own organization an environment that encourages learning and the discovery of new ideas.

The greatest need of the sales manager today is not even knowledge or skill. It is wisdom, or the capacity to judge soundly from cause to effect. Wisdom should not be associated with gray hair, stooped shoulders, and a slow gait. Though wisdom is fed by experience, its growth can be hastened by observing carefully and thinking deeply. The interchange of ideas with others surely promotes understanding.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Vise Jaws Serve as Adjustable Sine Bar Holding Fixture

By JAMES R. HANSEN, Bellevue, Wash.

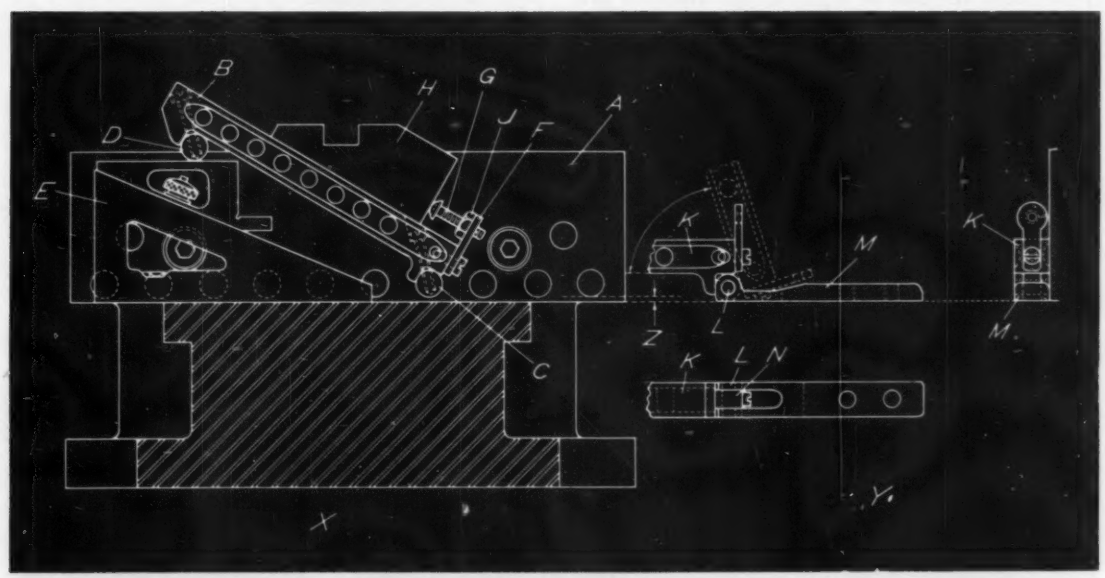
A sine bar is the heart of a versatile, quickly adjustable fixture intended for the rapid setup of parts on which angular cuts are to be taken. The fixture, which is formed between the jaws of a machinist's vise, can be adjusted to conform to any angle by simply changing the height of the gage-blocks or the planer gage that supports the sine bar.

Under certain circumstances, this adjustable nest, which is shown in the accompanying illustration, also can be used to support parts in position for compound angle cuts. Such a case might be when only a single-tilting vise or a plain sine plate is available. The second, or compound, angle then can be set transversely in the vise by means of the setup shown.

View X is a cross-section through a vise, looking toward fixed jaw insert *A*. A pattern of holes has been provided in the jaw insert at a known distance *Z* from the horizontal inner surface of the vise.

A short length of steel rod is screwed to each end of sine bar *B*—rod *C* at the lower end and rod *D* at the upper end. Rod *C* will fit snugly in any of the holes in the jaw insert, thus securely anchoring the lower end of the sine bar in a known position. Either gage-blocks or a planer gage *E* can be used to set the height of the upper end of sine bar *B*. It should be remembered that distance *Z* must be added to the normal height of the planer gage.

Stop-plate *F* is fastened to the lower end of the sine bar by a screw. Through the plate passes an adjustable stop-screw *G* which is used to position work-piece *H* at the desired height relative to the top of the vise jaws. Nut *J* will lock the screw at



The lower end of sine bar (B) is supported in holes drilled into fixed vise jaw insert (A), while the upper end rests on planer gage (E). Easy adjustment of the sine bar and rapid loading and unloading of work-pieces are features of this holding fixture.

the proper setting. The height of the work-piece can also be altered by inserting rod *C* in a hole further up on the jaw insert. In this instance, a new dimension must be substituted for Z.

In the event that holes cannot be provided easily in the vise jaw insert, a mobile hinged device, view Y, can be used. Here, sine bar *K* pivots around a hinge pin *L* which is supported by a clevis type hinge arm *M*. The hinge pin passes through a hole bored in the center of short rod *N* that is attached to the sine bar, fitting between the fingers of the clevised end of the hinge arm.

The hinged sine-bar unit can be placed between the jaws of a vise. Height adjustment of the unit as a whole is made by placing narrow parallels beneath hinge arm *M*. The arm and the parallels can be held in place by a standard hold-down clamp and a filler block with a bolt coming up from the T-slot in the machine table. Two clearance holes are provided in the hinge in case it should be necessary to bolt it directly to another surface such as a T-slot block in the work-table.

When the sine bar is used in the hinged form and is set up on parallels, the gage-blocks or planer gage that is used to support the upper end can be placed on the parallels also. In this case, no allowance should be made for distance Z or any other distance, as the sine bar is in a normal position, contacting the surface of the same parallel as is the planer gage.

Die for Twisting Bar Stock

By H. J. GERBER, Stillwater, Okla.

A die used for twisting bar stock by applying hydraulic pressure is illustrated in Fig. 1. Designed and built by a small shop manufacturing agricultural equipment, the die is used on flat bracing members which are given a 90-degree twist on both ends.

The twists are always equidistant from the ends of the bar regardless of its length. Utilizing a rack *A* and mating pinion *B*, a rotative motion is given to the slotted twisting jaw *C* which secures one end of the bar *X*.

The bar is fed from one side of a small hydraulic arbor press between a pair of guide rollers *D* and against the end of a slot in the twisting jaw *C*. The operator depresses a pedal-operated control valve on the press, and the ram descends, causing the rack to rotate the pinion to which the twisting jaw is keyed. After twisting, the operator keeps his foot on the valve pedal long enough to allow him to rotate the stock guide *E* 90 degrees, by means of a knob *F*. Thus, the rollers are removed from contact with the work-piece, and the bar is free to be unloaded.

After the bar is turned end-for-end, the operation is repeated. An adjustable positive stop (not shown) permits an accurate 90-degree bend. The complete assembly is contained in a die set for permanent alignment.

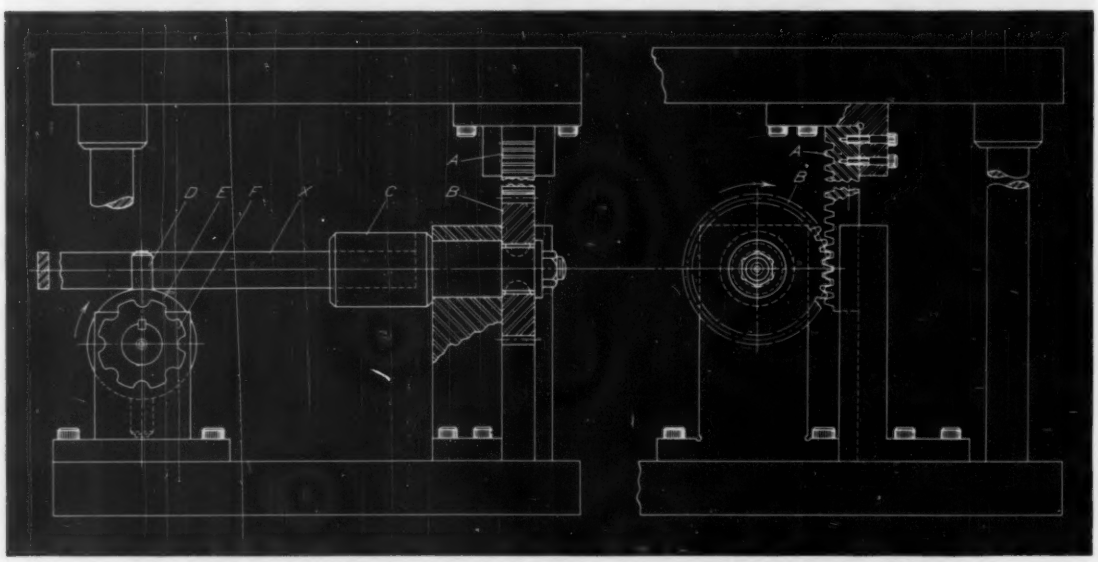
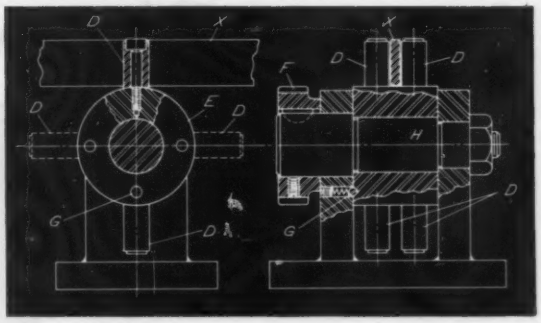


Fig. 1. When rack (A) descends, the end of bar (X) is rotated.

Fig. 2. Indexing stock gripper with stock guide (E) in working and unloading positions.



In the view of the stock guide, Fig. 2, a spring-loaded ball detent *G* can be seen in one of the support brackets, and four ball seats are spot-drilled 90 degrees apart in one face. This arrangement facilitates indexing the pairs of guide rollers into position for loading or unloading. Shaft *H* is a press fit in the stock guide.

Expanding Mandrel Utilizes Pressure of Rubber Hose

By W. M. HALLIDAY, Southport, England

To grip a work-piece internally on a lathe, an expanding mandrel utilizes the pressure of a short section of rubber hose. The device is used in conjunction with the draw-rod of an air chuck installed in the machine tool.

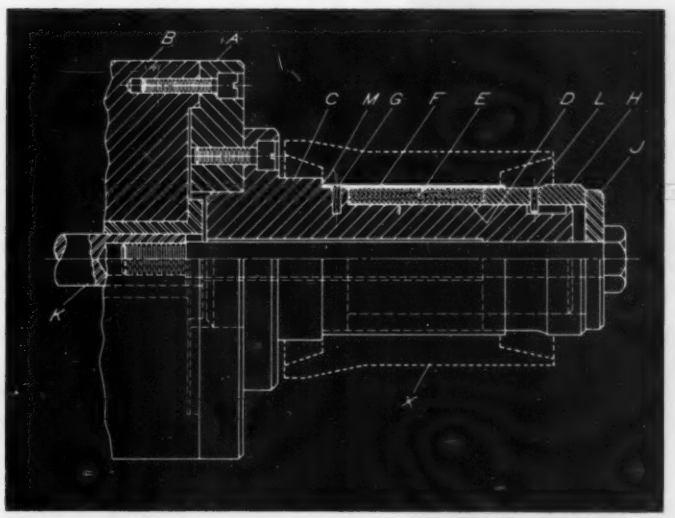
As shown in the accompanying drawing, an adapter plate *A* is fastened to the face of the chuck *B*. The body *C* of the mandrel has at its left end a pilot diameter fitting the bore of the adapter plate and a flange by which it is secured to the plate. For the major part of its length, the body accommodates the work-piece *X*, the bore of which has been machined to close limits in a previous operation.

Diameter *D*, containing the section of rubber hose *E*, is approximately 3/4 inch smaller than the bore of the work-piece. A thin sleeve *F* of high-tensile steel and having a wall thickness of 0.025 to 0.035 inch is a close fit both with the work-piece and the rubber hose. At its left end, the sleeve fits loosely over a pin *G* pressed into the body. This pin serves to keep the sleeve in position as work is removed from the mandrel.

Adjacent to the right end of the rubber hose is a bushing *H*. It projects over the end of the body and takes the thrust of a washer *J* when the draw-rod *K* is pulled in. The left half of the bushing has the same outside diameter as the hose, and the right half is about 0.005 inch smaller than the bore of the work-piece. As can be seen in the drawing, sleeve *F* extends for a short distance over the left half of the bushing. A pin *L* contained in the bushing rides in a slot in the body and restricts axial movement of the bushing to about 3/8 inch.

After a work-piece is positioned over the mandrel and located against a shoulder *M* on the body, the draw-rod is actuated. Thrust transmitted through the washer and bushing to the hose causes the rubber to flow axially and expand the sleeve. Expansion is uniform along the sleeve and around its periphery, so that a powerful grip is exerted on the work-piece.

By adjusting the air pressure of the chuck mechanism, the grip can be made to suit the particular machining requirement. Wall thickness of the rubber hose when not under pressure is approximately twelve to fourteen times that of the sleeve. After long use, it may be necessary to replace the sleeve, which tends to lose some of its springiness through fatigue. This device will also prove effective for thin-walled work-pieces which might be distorted by a conventional three-blade mandrel.



When the draw-rod (K) is actuated, rubber hose (E) flows radially, expanding sleeve (F) against the bore of the work-piece.

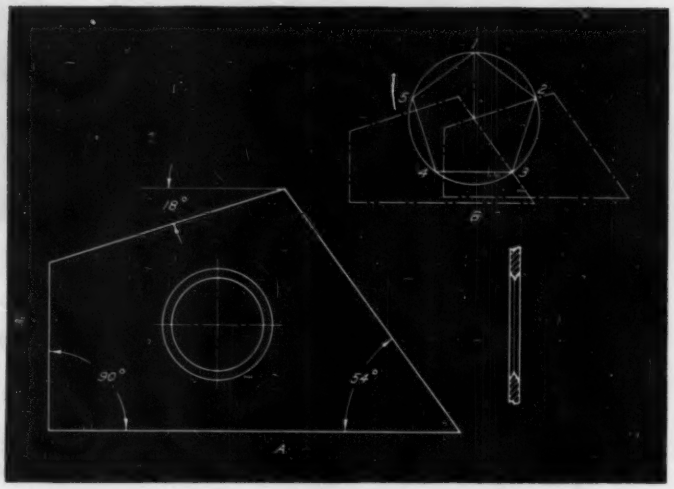
Ideas for Shop and Drafting-Room

Angle Gage for Pentagons

By John Homewood, Burbank, Calif.

Draftsmen working with pentagons will find the four-sided gage shown in view A of the accompanying illustration useful in striking off various angular divisions of the figure. The gage can be readily made of celluloid to the shape shown. A knife-edge window facilitates lifting it off the drawing board.

To lay out a pentagon, as in view B, the circumscribing circle for the figure is drawn first. Then a perpendicular line through the circle center fixes corner 1. Corners 2 and 3 are obtained by placing the base of the gage normal to this line in the positions illustrated. The gage is simply moved laterally until each of the two upper edges intersects the locus of the circle. To locate corners 4 and 5, the gage is flipped over and used in an identical manner.



Divisions of a pentagon can be rapidly struck off with this gage.

Boring Two Internal Chamfers

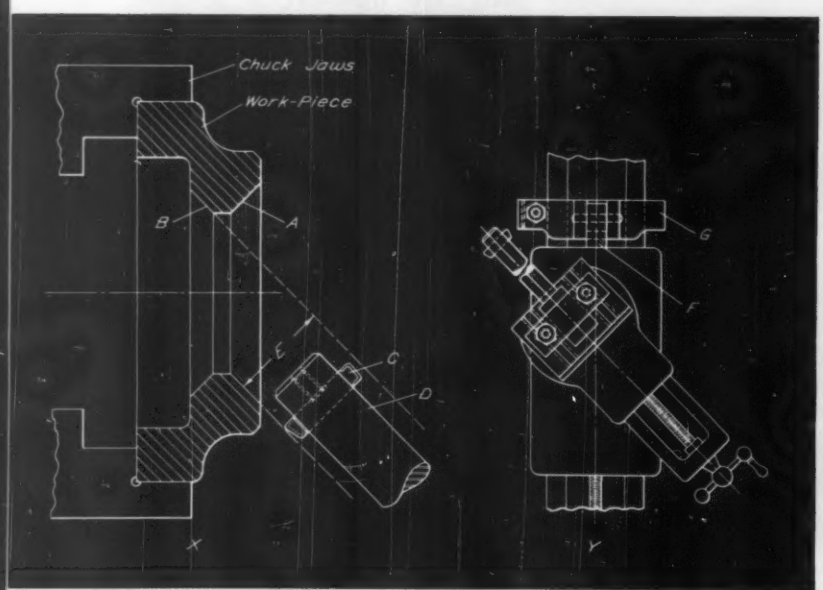
By William Morson, Birkdale, England

Two internal chamfers may be machined in one setup by the method to be described. The two chamfers *A* and *B*, shown at X in the illustration, are to be finish-bored by a double-ended tool bit *C* mounted in a cylindrical boring-bar *D*, instead of by the usual single-point cutter.

The left-hand cutting edge of the tool bit is ground on its upper face, while the right-hand cutting edge is ground on its lower face. During grinding, care must be taken so that the over-all length of the cutting tool is approximately 1/8 inch less than distance *E*.

Chamfer *A* is bored first, the tool bit being fed by advancing the compound rest only. For this phase of the operation, the cross-slide is positioned against latch *F* of a special stop assembly *G*. This stop assembly is secured to the cross-slide guide-ways.

To bore chamfer *B*, latch *F* is raised, thereby allowing the cross-slide to be advanced until it contacts the main member of the stop assembly. By once again advancing the compound rest, the second chamfer may be formed. Only a few seconds is required to adjust the stop from one setting to the other.



Simple stop unit permits rapid boring of two internal chamfers.

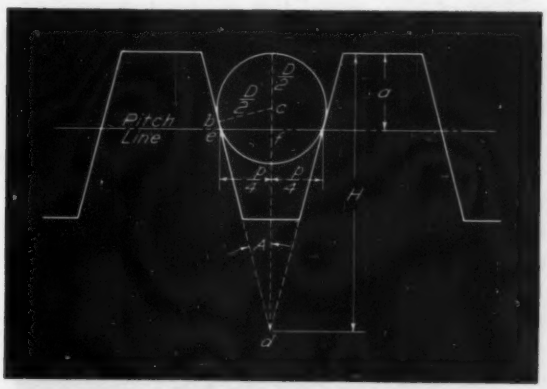
MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Measuring Racks with Flush Pins

A popular method for checking the teeth of racks is based on the use of a pin that will be flush with the tops of the rack teeth when placed in a tooth space. This method is particularly useful in jobbing shops where racks of coarse pitch are cut, because it permits measurements to be made without removing the work from the machine. What pin diameters are used for various pitches in 14 1/2-, 20-, and 30-degree pressure-angle, full-depth involute systems?



If a pin of predetermined diameter is flush with the tops of the teeth, as shown, then the rack has been cut to size

Solution:

The accompanying diagram shows a pin in flush position for a correctly cut tooth. The addendum a is equal to 0.3183 × circular pitch p; D = diameter of pin; A = pressure angle; and H = distance shown.

By trigonometry, using triangle *efd*,

$$H = 1/4\ p \cot A + a \qquad (1)$$

Also, from triangle *bcd*,

$$H = 1/2\ D \csc A + 1/2\ D = 1/2\ D\ (1 + \csc A) \qquad (2)$$

Substituting H from Equation (2) in Equation (1) and solving for D,

$$1/4\ p \cot A + a = 1/2\ D\ (1 + \csc A)$$

$$D = \frac{1/2\ p \cot A + 2\ a}{1 + \csc A} \qquad (3)$$

For 14 1/2-degree pressure-angle, full-depth involute teeth, $a = 0.3183\ p$, cot 14 1/2° = 3.8667, and csc 14 1/2° = 3.9939, so that from equation (3)

$$D = 0.5146\ p \qquad (4)$$

For 20-degree pressure angle, $a = 0.3183\ p$, cot 20° = 2.7475, and csc 20° = 2.9238, so that

$$D = 0.5124\ p \qquad (5)$$

For 30-degree pressure angle, $a = 0.3183\ p$, cot 30° = 1.7320, and csc 30° = 2.0000, so that

$$D = 0.5009\ p \qquad (6)$$

Example: For a rack of 0.2500-inch pitch p, what pin size is required for flush measurement if the pressure angle is 14 1/2 degrees?

Using Equation (4),

$$D = 0.5146 \times 0.2500 = 0.1286 \text{ inch}$$

Send in your interesting problem and its solution for presentation on this page

LATEST DEVELOPMENTS IN *Shop*

Heald "Bore-Matic" Equipped for Precision Facing Automatic Transmission Parts

A special "Bore-Matic" for precision facing automatic transmission parts has been developed by the Heald Machine Co., Worcester, Mass. Geared to meet the high production requirements of the automotive industry, this machine provides continuous valve body production at the rate of 270 parts per hour at 75 per cent operating efficiency.

A constantly rotating trunnion type fixture moves the parts in a circular path between and at right angles to the two boring heads. These heads are in opposed positions and permit simultaneous precision facing of two valve bodies clamped on either side of the fixture. The twelve-station fixture rotates at the rate of approximately 1/2 R.P.M., producing two completely finished parts every twenty seconds.

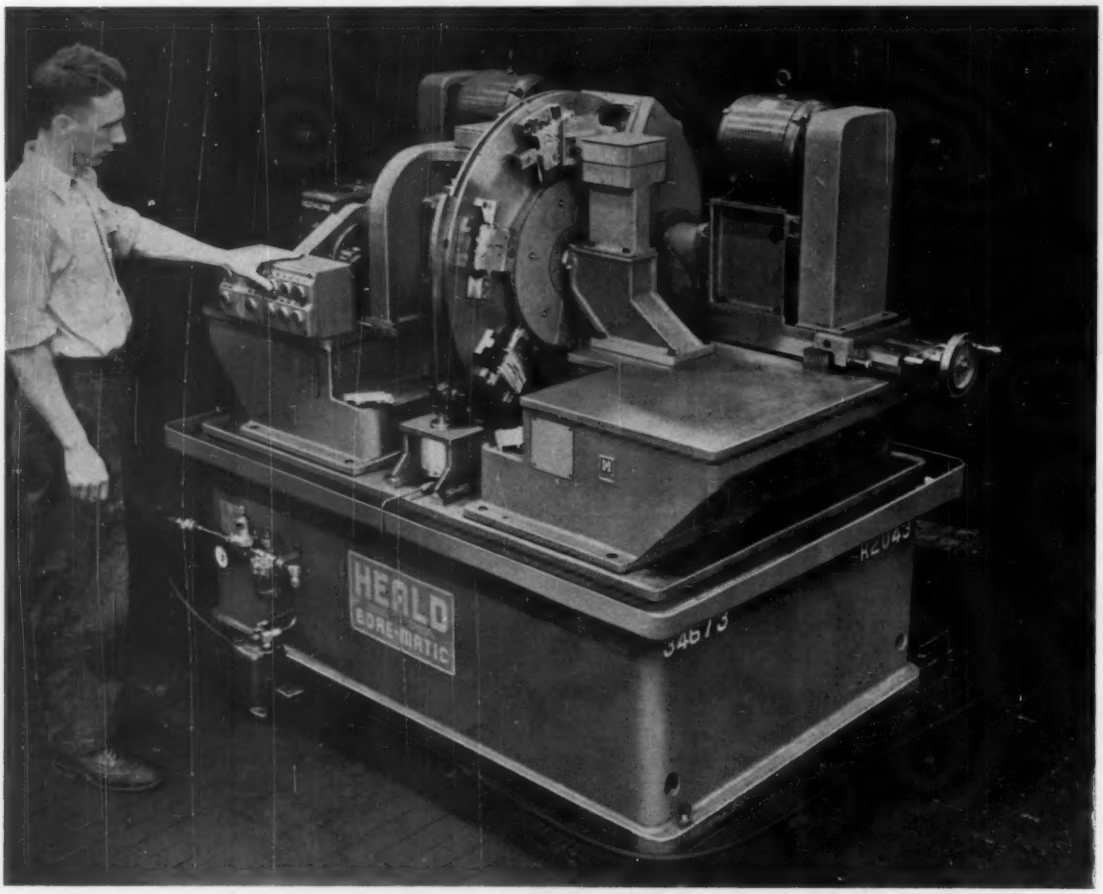


Fig. 1. "Bore-Matic" developed and equipped for precision facing automatic transmission parts

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

Tooling consists of two multiple holders, each carrying eight single-point carbide facing tools. Boring heads to which tool-holders are fastened are slide-mounted and have a 6-inch travel for tool changing or stock removal adjustment.

In normal use, the operator's attention is limited to loading and unloading parts. The fixture has a foot-operated release that leaves the operator's hands free to unload and load sets of parts during a 60 degree segment of fixture rotation without stopping the machine. Raw parts pass through checking stations prior to machining. Micro switches, connected to the checking mechanism, stop rotation of the fixture if a part is improperly loaded or has excessive stock. Push-button control provides for reversal of fixture rotation to permit repositioning or removal of a defective part.

Features of this machine include ample work- or part-storage area at the right end of the base, an access door at the rear of the machine to facilitate machine setup, and a gravity chip chute that is built into the base and inclined toward the rear of the machine. The operating cycle is completely push-button-controlled. The machine removes stock (aluminum) to a depth of 0.050 inch and provides a finish of 20 micro-inches or better with excellent flatness. Although this machine is designed primarily for manual loading and unloading, special conveyor and part handling equipment can be provided to obtain a completely automatic setup.

Circle Item 101 on postcard, page 263

General Electric "Thy-Mo-Trol" Fractional-Horsepower Drives

A complete line of fractional-horsepower "Thy-mo-trol" drives, incorporating the latest in printed circuit techniques, has been announced by the Specialty Control Department of the General Electric Co., Schenectady, N. Y. This line of electronic, adjustable-speed drives includes both full-wave and half-wave units and spans a rating range from 1/50 to 3/4 H.P.

The "Thy-mo-trol" drives employ rectified alternating current to furnish direct-current power to the drive motor. Very precise control of speed is obtained, and constant torque is supplied over the entire speed range. The drive can

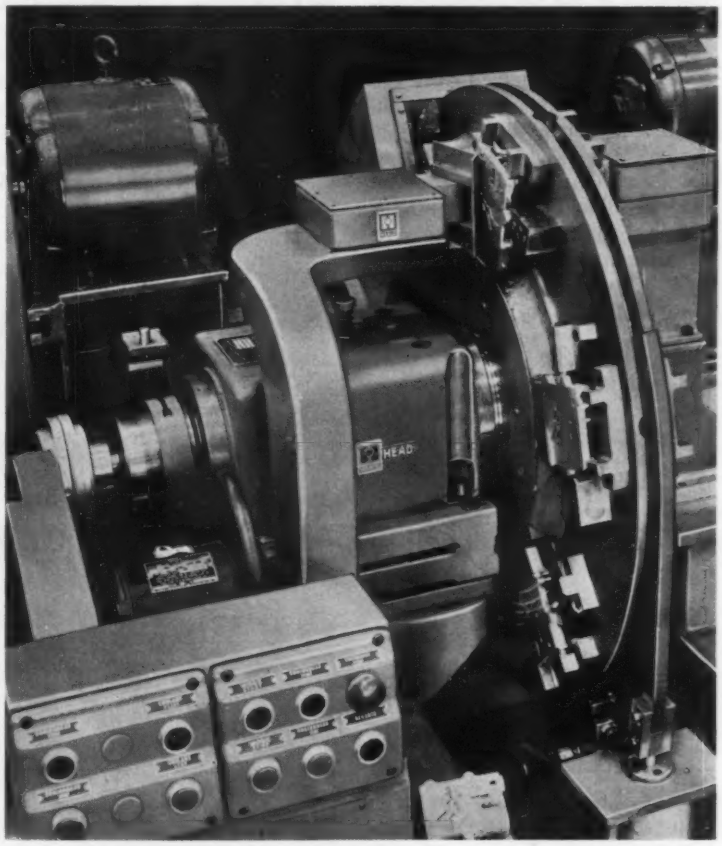


Fig. 2. Close-up of special Heald "Bore-Matic" setup for facing automatic transmission parts

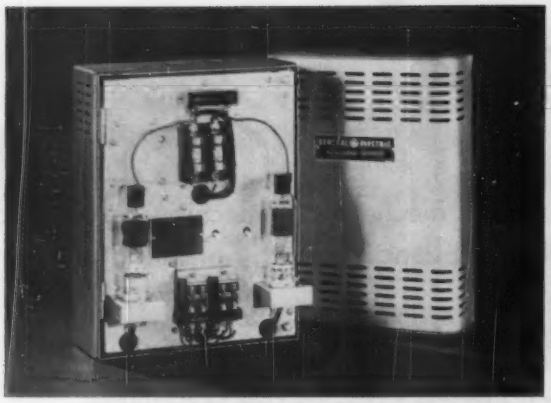


Fig. 1. General Electric full-wave "Thy-mo-trol" drive with cover removed from unit

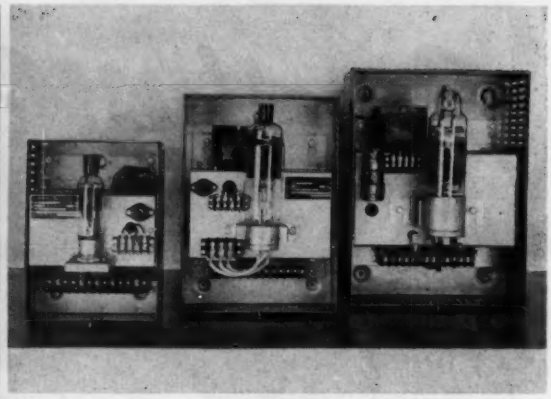


Fig. 2. Subpanels of "Thy-mo-trol" drives with plug-in printed circuit wiring boards

be set for the desired speed by means of a speed control potentiometer in the control station.

One of the most important features of this line is the use of plug-in printed circuit boards in the half-wave equipments. These boards permit assembly and disassembly of the basic panel without removal of a single wire. In addition, the printed board itself can be rapidly removed from the subpanel and replaced as a unit.

Another outstanding feature of the half-wave unit is the excellent speed regulation—3 per cent no load to full load. Only one tube is required in the simplified circuit which employs half-wave rectification. Units are small, self-contained, and easily built into a machine. They are available in ratings from 1/50 to 3/4 H.P.

The full-wave unit employs a full-wave rectification circuit designed to minimize torque pulsations. It also permits current limit for smooth acceleration. The speed regulation of this unit is 5 per cent from no load to full load. Full-wave drives are available in ratings of 1/4, 1/3, 1/2, and 3/4 H.P.

Motors used with these drives are especially designed and selected units which deliver constant torque over their speed range of 20 to 1. Standard motors are available in dripproof or totally enclosed construction. Dynamic braking and overload protection are available with all drives.

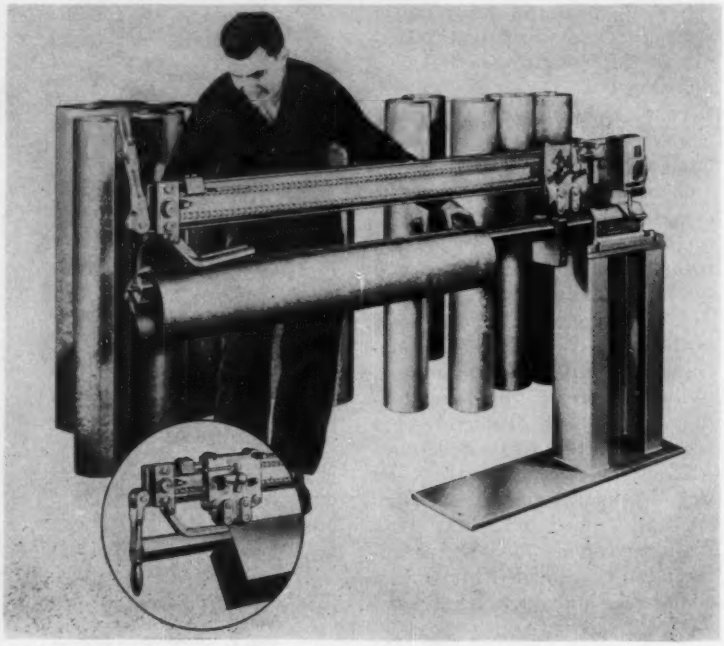
Circle Item 102 on postcard, page 263

Universal Power Grooving Machine for Closing Lock Seams

Niagara Machine & Tool Works, Buffalo, N. Y., has brought out a Model No. 48-U universal power grooving machine that has been equipped for accurate, rapid, and easy operation. A newly designed multi-purpose horn furnished as standard equipment is a feature of the machine. This horn can be easily rotated and locked in any one of several positions for closing single lock seams on inside or outside of square and round work or Pittsburgh type lock seams on square work.

The machine is driven by a direct-connected gear head motor. Stops hold work stationary on the horn, and adjusting wheels permit close regulation of roll pressure to conform with thickness of material. With a nominal working length of 48 inches, the machine has a single lock seaming capacity of 20 gage mild steel.

Circle Item 103 on postcard, page 263



Niagara universal power grooving machine for closing lock seams

Line-O-Matic for Processing Rear-Axle Housings

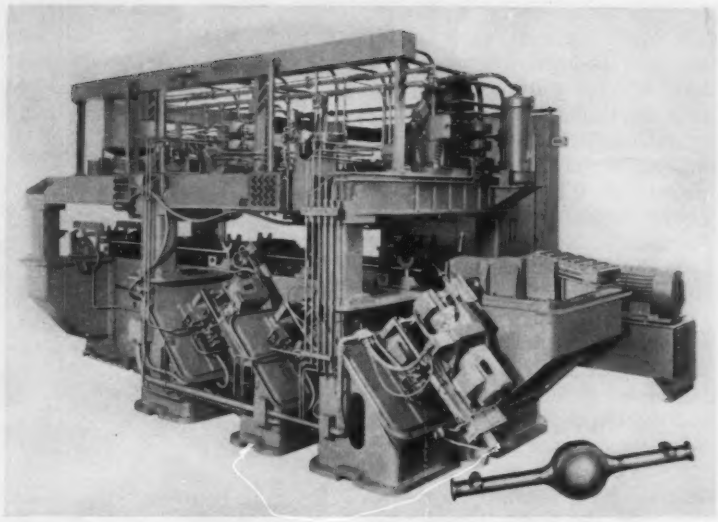
LaSalle Tool, Inc., Detroit, Mich., has announced a completely automatic machine, called "LaSalle Line-O-Matic," designed for installation in the production line. This machine is equipped to process rear-axle housings for both passenger cars and trucks. It will handle any one of three different housings consisting of welded assemblies on which there has been no previous machining. The machine not only automatically pierces, extrudes, machines, and assembles but, in addition, automatically loads and unloads the work.

When the part is automatically loaded into the machine from the conveyor line, it trips a limit switch which, in turn, starts the machine cycle. A shuttle advances the part to the next station, lifting it into the fixture. Then the shuttle returns. The work is located up and down from four points on the banjo face. The endwise location is taken from four points inside the banjo housing. For angular location, as well as up-and-down clamping, a point is taken on the tube just outside the banjo section.

At the first work-station, drawing compound is automatically applied, and then the drain-hole is hydraulically pierced and extruded. At the second station, the drain-hole is tapped for a 3/8-inch pipe plug, and the vent-hole is drilled for a 1/4-inch pipe plug. At the third work-station, Permatex is applied to the drain-hole. There is a built-in system on the machine for metering and measuring the exact amount of Permatex required. Also, at this station, both sides of the vent-hole are deburred.

At the fourth station, the machine automatically feeds and runs the 3/8-inch pipe plug into the drain-hole with a tightening torque of 30 foot-pounds. The supply of pipe plugs is hopper-fed. In addition, the vent-hole is tapped for a 1/4-inch pipe plug. At the last station, the rear-axle housing is turned over and unloaded onto the conveyor line.

Circle Item 104 on postcard, page 263



LaSalle "Line-O-Matic" built for processing rear-axle housings

Red Ring Automatic Loader for Gear-Shaving Machines

A Red Ring fully automatic loading device for handling spur or helical internal gears on shaving machines has been placed on the market by the National Broach & Machine Co., Detroit, Mich. This device was developed to solve the difficult automatic loader design problem of meshing the teeth in an internal gear with those of the helical-gear-shaped shaving cutter. An intermediate air-powered work-loading sleeve mechanism receives the internal gears one-at-a-time from a magazine feed, hangs them on the cutter and thus provides the solution to the meshing problem. The loader can be installed on the company's Model GCR internal shaving machine, Fig. 1.

Internal gears to be shaved are loaded in a magazine where they roll by gravity to a position in

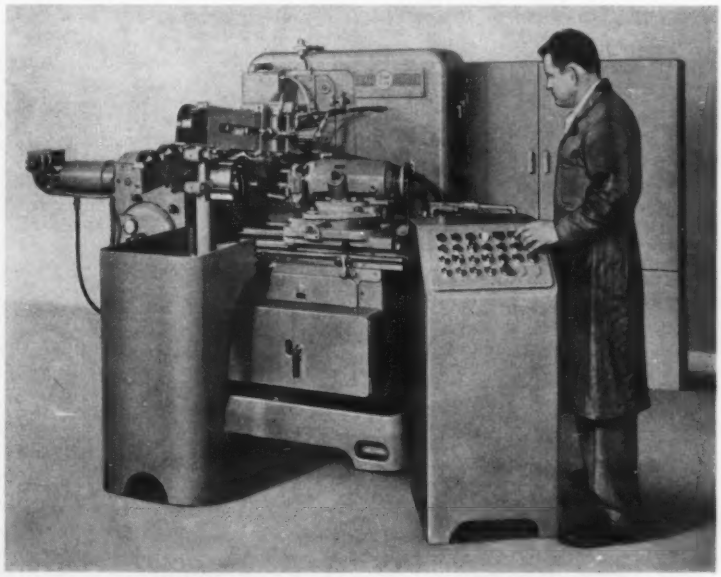


Fig. 1. Red Ring fully automatic loader for internal gear-tooth shaving machines

front of an air-powered plunger. The plunger pushes one gear at a time into the loading sleeve, which is mounted on a swinging arm and is swung through an arc by an air-cylinder-controlled linkage. Pushing an unshaved gear into the sleeve at this raised position causes a finish-shaved gear in the other end to be deposited in an unloading magazine in which it rolls to the front of the machine.

In the next loader operating sequence, the sleeve holding the unshaved gear is swung downward by the air cylinder into line with the work-spindle center line. A finish-shaved gear in the chuck on the work-head is ejected by another air cylinder into the sleeve. Entry of the finish-shaved gear ejects the unshaved gear in the other end of the sleeve, bringing it into mesh with the shaving cutter, Fig. 2, where it remains hanging on the cutter.

Then the loading sleeve is raised to the load position. The internal gear and shaving cutter are advanced as a unit toward the chuck in the work-head, and the gear is chucked, ready for the shaving operation with the cutter in mesh with the gear. At the end of the shaving operation, the cutter-spindle is backed out of the gear and returned to its original position for reloading.

Circle Item 105 on postcard, page 263

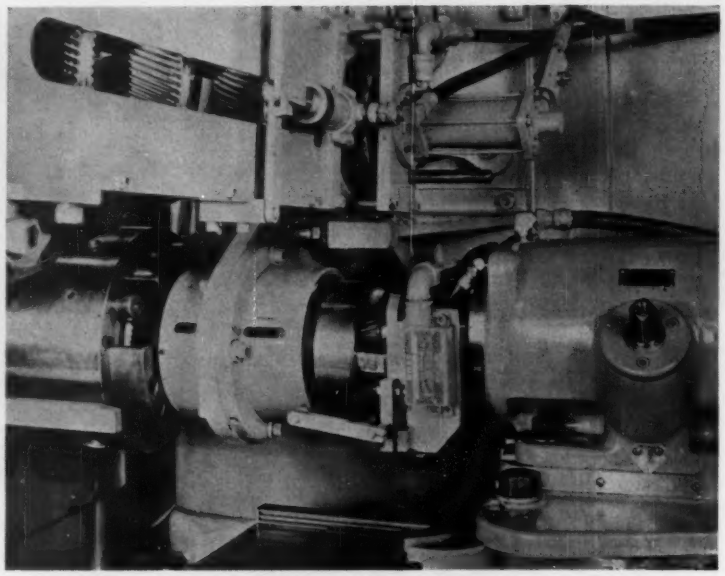


Fig. 2. Close-up of Red Ring automatic loader on machine in Fig. 1

Torque-Wrench Testing and Calibrating Machine

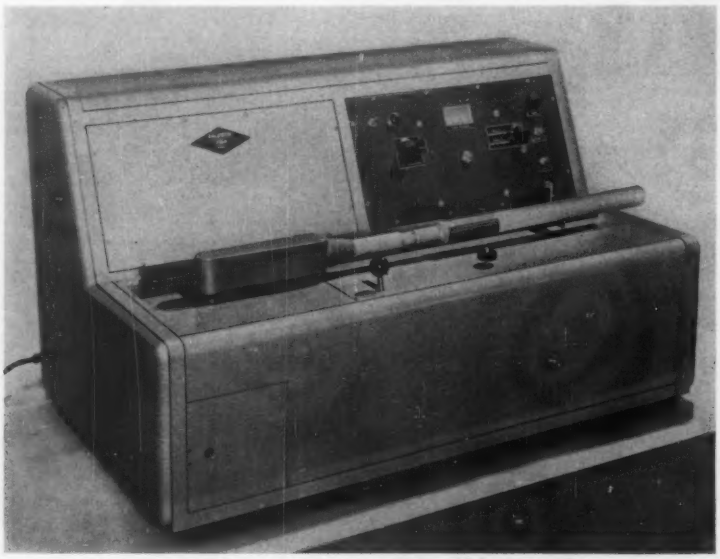
Torque-wrench calibration is said to have been simplified and made more accurate through the use of a new type tester announced by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. In this tester, torque is measured electrically by means of special SR-4 resistance wire strain-gage type torque transducers. The first tester was recently designed and built by the corporation's Electronics and Instrumentation Division, Cambridge, Mass., for checking torque wrenches used on aircraft. Other devices can now be calibrated with minor modification of the tester.

The tester is of rugged design, portable, maintains its accuracy through a wide temperature range, is easy to use, and covers a wide range of torque-testing capacity. The torque-measuring system consists of an electronic amplifier and an indicating instrument with rotating dial on which torque can be read in inch-pounds: 1 inch-pound per division up to 2040 inch-pounds and 5 inch-pounds per division up to 6200 inch-pounds. The low range is provided in five steps of 440 torque divisions each, and the high range, in three steps of 440 divisions each. Separate torque pick-ups are used for the two ranges.

Loads are applied on the handles of torque wrenches hydraulically through an adjustable fulcrum, and the tester is powered by plugging into a 115-volt, 60-cycle electric line. Pick-up cells are provided with hexagonal, square, and special adapters.

The tester is 40 inches long, 24 inches deep, 18 inches high, and weighs 300 pounds.

Circle Item 106 on postcard, page 263



Baldwin-Lima-Hamilton torque-wrench testing and calibrating machine

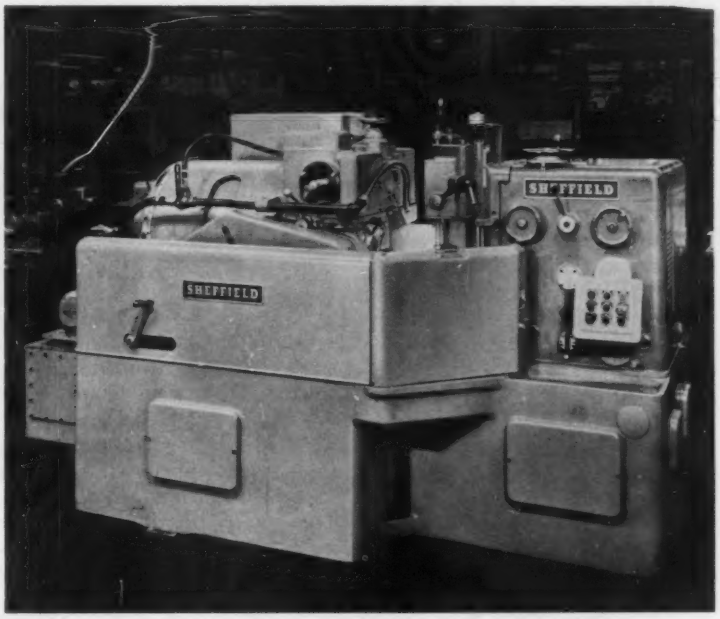
Sheffield Gear-Tooth Grinding Machine

A machine for grinding the teeth of external precision gears of from 8 to 100 diametral pitch has been developed by the Sheffield Corporation, Dayton, Ohio. Both spur gears and right- and left-hand helical gears can be produced. The machine is intended for such gears as are used in precision instruments, timing devices, fire-control mechanisms, aircraft accessory power units, machine tools, transmissions, and other applications in which quiet operation is necessary.

The grinding wheel is dressed to the basic rack form by applying the automatic Crushtrue process. The gear blank or blanks are mounted between headstock and tailstock centers.

The operation is similar to hobbing in that the work rotates continuously at a rate of speed that is synchronized with the speed of the grinding wheel. The work moves upward past the horizontal center of the wheel until the tooth form has been imparted to the full face of the gear blank. In addition to this basic hobbing motion, the work rolls across the full face of the helical rack form on the grinding wheel.

Gears up to 8 inches in outside diameter and 5 inches in face width can be handled by the standard Model 140 gear-grinding machine. The maximum length between centers on this machine is 15 inches. Change-gears permit the grinding of from 4 to 192 teeth on a gear. Helix-angle adjustment of wheel-head is 45 degrees right- or left-hand.



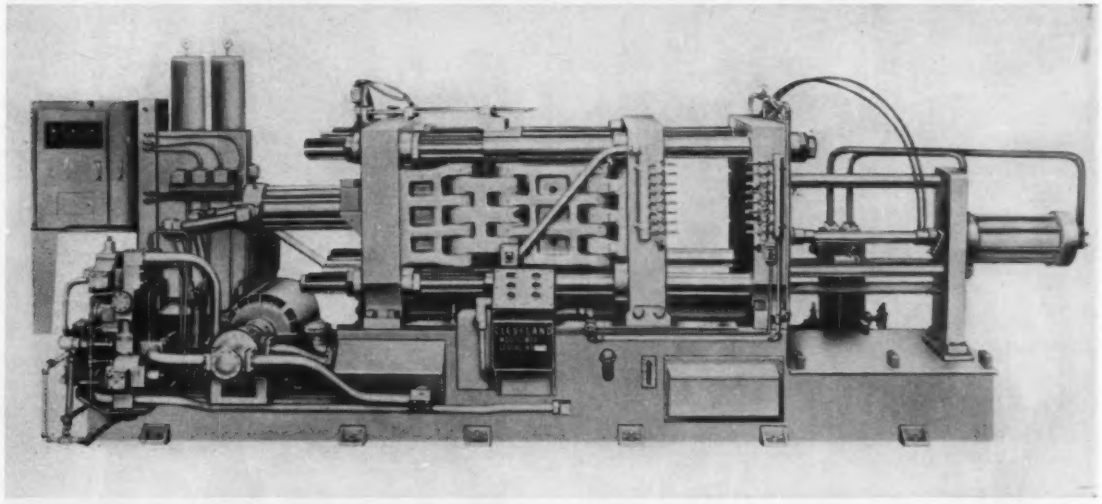
Sheffield gear-tooth grinding machine that can be applied to preformed or solid blanks

Circle Item 107 on postcard, page 263

Cleveland Automatic Die-Casting Machine

The Cleveland Automatic Machine Co., Cincinnati, Ohio, has announced a 600-ton die-casting machine designed for rapid production and easy operation. The locking pressure of this Model 600 machine is strain-gage tested to assure locking the dies securely with the full rated pressure of 600 tons. Thus, castings having a minimum of flash are produced.

Two Vickers pumps, driven by



Automatic die-casting machine brought out by the Cleveland Automatic Machine Co.

a 30-H.P. motor, deliver 99.7 gallons per minute to provide for the fast cycling operation. A 200-gallon hydraulic reservoir and filter serve to insure maximum pump life.

The massive die-plates are cut from solid steel blocks to decrease deflection to a minimum, and four large-diameter, high-carbon steel tie-bars add rigidity and resist stretching under the locking pressure. Each tie-bar is deep-hole drilled and can be supplied with indicator rods and indicators for even distribution of the locking pressure load. Husky cast-steel toggles and hardened-steel toggle pins and bushings maintain pressure when the die is closed. An automatic system insures safe lubrication of all wear points.

The completely universal, automatic timing-control panel is designed to provide all desired cycles for die-casting and to insure uniform castings of the highest quality. This main electric panel is remote from the machine so that the electrical controls are not subjected to any machine vibrations. Push-buttons necessary for setup and operation are located within easy reach of the operator.

Die-plates are 46 1/2 by 46 inches, and the space between tie-bars is 28 by 28 inches. Die thickness ranges from 10 to 30 inches, and the die opening, from 8 to 15 inches. The tie-bars are 5 inches in diameter. A floor space of 98 by 246 inches is required. The hot-chamber model weighs 42,500 pounds and the cold-chamber model weighs 35,500 pounds, approximately.

Circle Item 108 on postcard, page 263

Huge Keller Automatic Tracer-Controlled Milling Machine

One of the largest Keller automatic tracer-controlled milling machines ever manufactured has just been assembled by the Pratt & Whitney Co., West Hartford, Conn., and shipped to the Douglas Aircraft Co., Santa Monica, Calif. This huge 73-ton machine will be used to mill forgings for the country's most advanced jet-powered aircraft.

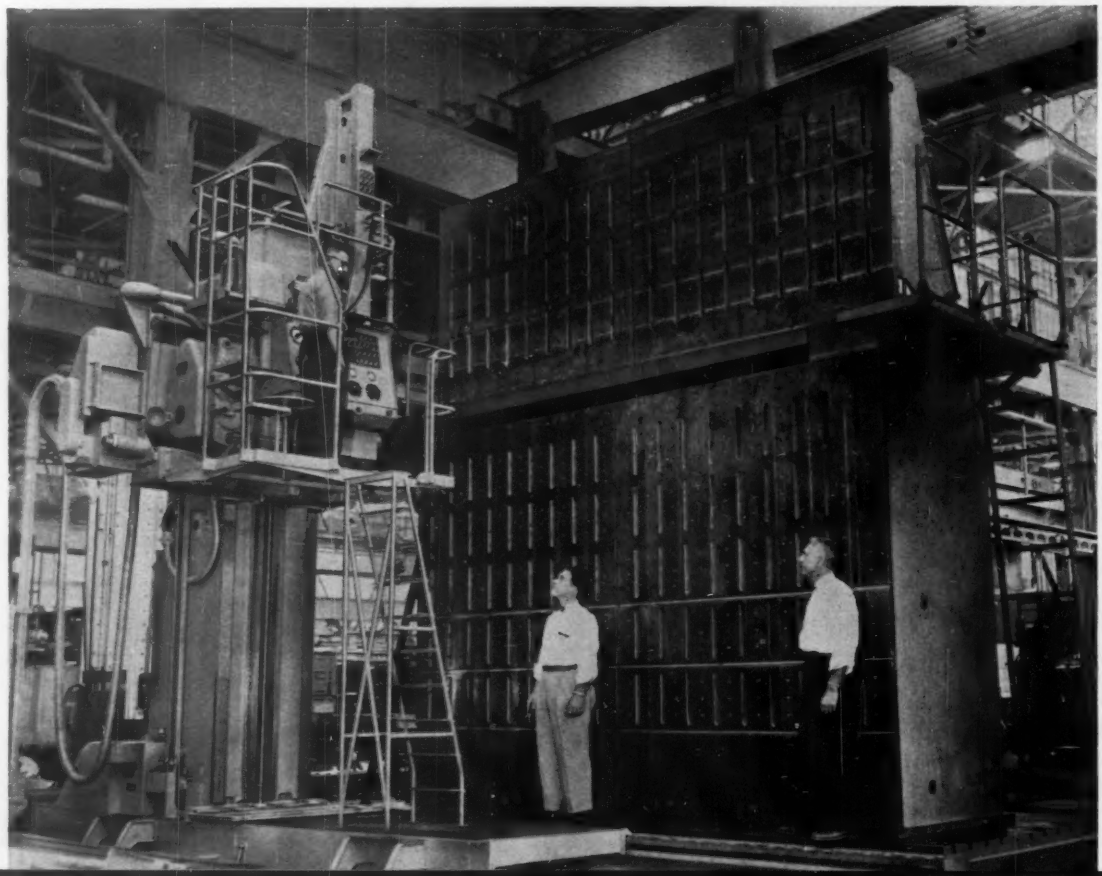
This Keller Type BG 22 machine has a horizontal travel of 14 feet and a vertical travel of 7 feet. The fixture is of weldment construction designed to meet rigidity requirements made necessary by increased horsepower. It weighs approximately 60,000 pounds, and was fabricated by Avery & Saul, Cambridge, Mass.

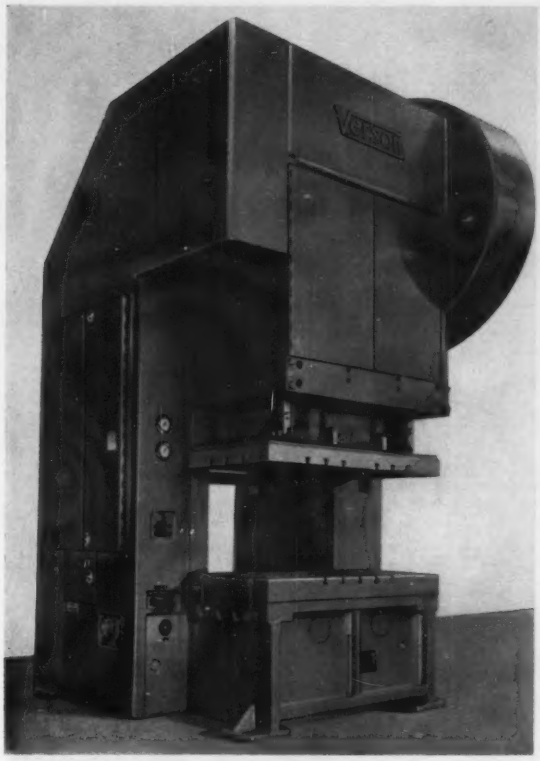
The fixture consists of two lower sections bolted together, each 7 feet wide by 9 feet 8 inches high and 4 feet 6 inches deep. It is 14 feet wide and stands 16 feet high above the machine table. The front plate of the lower fixture is 3 feet thick. All of the vertical slots were cut by torch and required no further machining.

The Keller machine complete with fixture, as shown in the accompanying illustration, has a total weight of approximately 146,000 pounds. It required four boxcars for shipment.

Circle Item 109 on postcard, page 263

Keller automatic tracer-controlled milling machine assembled by the Pratt & Whitney Co.





Gap press built by the Verson Allsteel Press Co. for use in automation lines

Rockwell motorized hardness tester introduced by American Chain & Cable Co.

Verson Streamline Gap Press

A streamline gap press, designed and built by the Verson Allsteel Press Co., Chicago, Ill., features totally enclosed piping and wiring of all air, lubrication, and electrical components. Gears, flywheel, clutch, and all other moving parts are also fully enclosed. Safety features serve to protect both operator and press.

The die-space area is well lighted for working convenience, and there are receptacles and pockets for safety blocks to prevent the press from operating while men are working in danger areas. Service outlets for 440- and 110-volt electric circuits provide power for portable electric tools, and a self-contained air supply system has service outlets for air-powered tools or equipment. The exact position of the ram at any point in the stroke is shown by an electric indicator.

The press contains a completely automatic lubrication system with all gears totally enclosed and running in oil. A central lifting hook simplifies setting and moving the press. It is even possible to have the press moved from one position to another for convenient location setups on special jobs. The complete electrical control system includes extra outlets and cams for tying the press into automation lines and for automatically operating ejector type dies.

Circle Item 110 on postcard, page 263

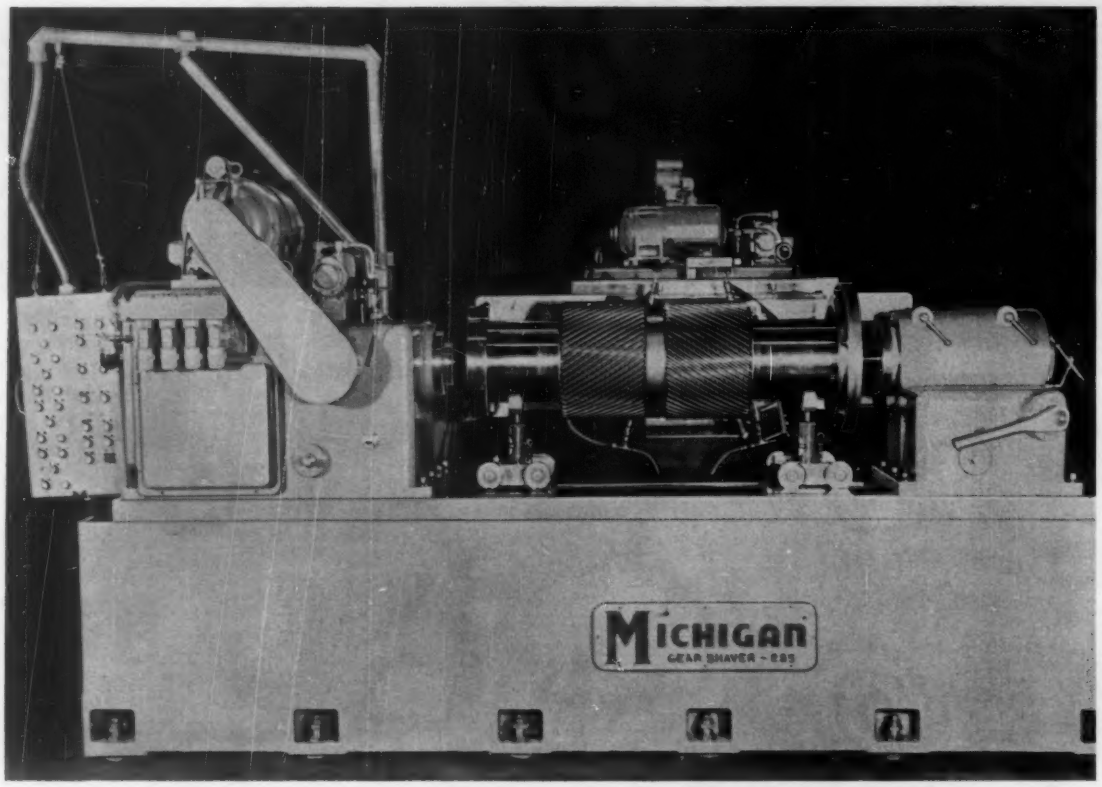
Rockwell Hardness Tester

A semi-automatic Rockwell motorized hardness tester, designated Model Y, has been brought out by the Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., Bridgeport, Conn. This high-capacity unit, incorporating many of the latest developments in hardness testing equipment, is being introduced at Booth 1211 at the thirty-eighth National Metal Congress and Exposition in Cleveland.

A feature of this instrument is the short test cycle that permits an increased number of Rockwell readings to be taken and recorded within a definite time period. Other features include an illuminated dial gage, indenter light, and "Set-O-Matic" dial gage. With the latter gage, the large hardness indicator pointer need not be set to zero manually because the pointer will automatically return to zero when a minor load is applied.

The motor's function in the test cycle is to remove the major load. The cycle time of major load operation may be adjusted to less than two seconds. Application of the load is controlled through a dashpot, which gives variable-speed control if desired. Power is supplied to the unit from a 110-volt, 60-cycle, single-phase alternating-current line. The heavy-load Model LR Tukon, a combination micro- and macro-hardness tester, will also be displayed at the exposition, together with other hardness testing equipment.

Circle Item 111 on postcard, page 263



Special shaving machine built by Michigan Tool Co. for finishing large pinions

Shaving Machine for Finishing Large Turbine Pinions

Development of a special shaving machine for finishing large pinions such as required for turbines used in seagoing vessels and power-generating plants is announced by the Michigan Tool Co., Detroit, Mich. The finishing rate possible with the large machine is said to be from 10 to 15 times as fast as that previously obtained—despite the fact that the machine is designed for extreme precision in finishing high-cost parts.

The machine is extremely versatile and can shave a gear located in any position on a 100-inch long shaft. Dual shaving cutters can be used to materially reduce machining time when pairs of gears are located close together, as shown in the illustration.

Push-button controls for most of the basic machine functions give extremely close control over setting up and machining operations. Thirty-two push-buttons are provided on the pendant control box for spindle-speed selection, fast or slow in-feed, cycle start and stop, and traverse feeds. The control box is mounted on a pivoting bracket to facilitate operation from the front, side, or back of the machine.

Among the special features available on this Model 885 machine are hydraulic lift jacks that raise the heavy work-piece into position for mounting between centers and for supporting the finished work-piece when unloading. The amount of metal to be removed is shown on an electronic indicator that permits controlling the depth of cut to 0.0001 inch. The length of the shaving pass is controlled by limit switches at both ends of the gear being shaved.

As soon as the shaving cutter completes its work and actuates the limit switch, the work-drive motor is plugged to a stop and the slow traverse feed motor stops. Should the operator desire to stop the machine for any reason before the shaving cycle is completed, he merely depresses the cycle-stop button. For emergency stops, a pendulum switch below the push-button pendant can be readily reached by the operator from front, side, or rear of the pendant station.

Checking of the gear being shaved is accomplished by a composite checker designed as an integral part of the machine. A spur master gear of the proper pitch and pressure angle is provided together with either a visual or recorded means of indicating reading on the work gear. During the shaving cycle, the checking head is moved out of the way by means of a handwheel.

Ten different motors ranging in size from 1/3 to 5 H.P. are provided for the work-drive, fast and slow traverse feed, fast and slow in-feed, rear column cross-feed, and for separation of coolant and chips. All circuits are electrically interlocked so that neither machine nor work will be damaged by accidentally depressing any push-button.

Circle Item 112 on postcard, page 263

Fig. 1. Three nine-station Cross Transfer-matics and two identical four-way boring machines equipped to completely finish tractor differential center housings

Cross Machines Comprise Complete Production Line for Differential Housings

Forty-six tractor differential center housings are completely machined per hour on a line of three Transfer-matics and two precision boring machines developed by The Cross Company, Detroit, Mich. A unique feature of this installation is the simple way the parts are transferred, located, and clamped in Sections 2 and 3. Transfer bars lift the part from one station and carry it to the next, where it is lowered over two locating pins fixed to the base of the machine. Target center holes machined in the top face in Section 1 are then engaged by two centers in the overhead bridge to hold the part in the working position.

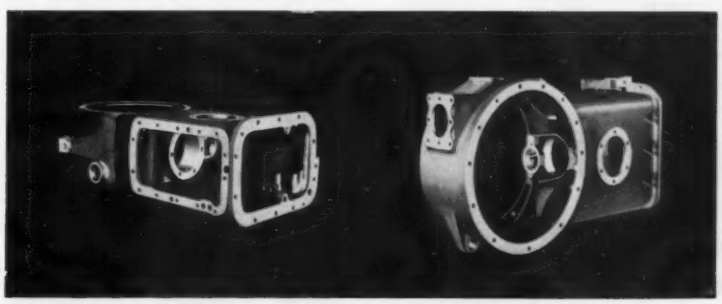
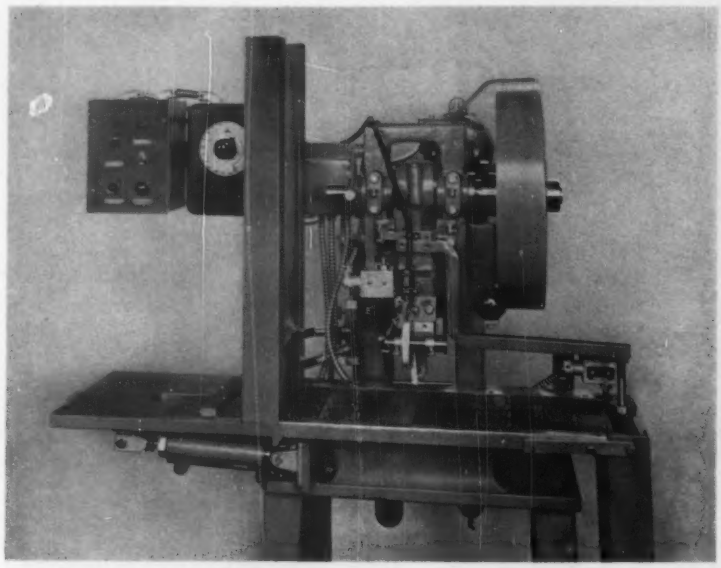


Fig. 2. Tractor differential housings finished on line of Cross production machines shown in Fig. 1

The line is 32 feet wide, 225 feet long, and consists of thirty-one stations divided into four sections. The first section machines the top and the bottom of the housings; the second, the two sides; the third, the ends; and the fourth precision finishes the important bores.

Section 1 is a nine-station, pallet type Transfer-matic; Section 2, a nine-station Transfer-matic; Section 3, another nine-station Transfer-matic; and Section 4, two identical Cross four-way boring machines equipped with single-point tools that perform all of the final finishing operations.

In the finishing machines, the part is located by the two reamed holes in the bottom face and clamped through the target center holes in the top face. Then the two rear-axle housing pilot bores



Hot-stamping press made by the Acromark Co.

are finish-bored and faced from the sides, the bevel pinion shaft hole is finish-bored from the front end, and the intermediate power take-off shaft hole is finish-bored from the front and the rear ends. By finishing all bores simultaneously indexing errors are eliminated.

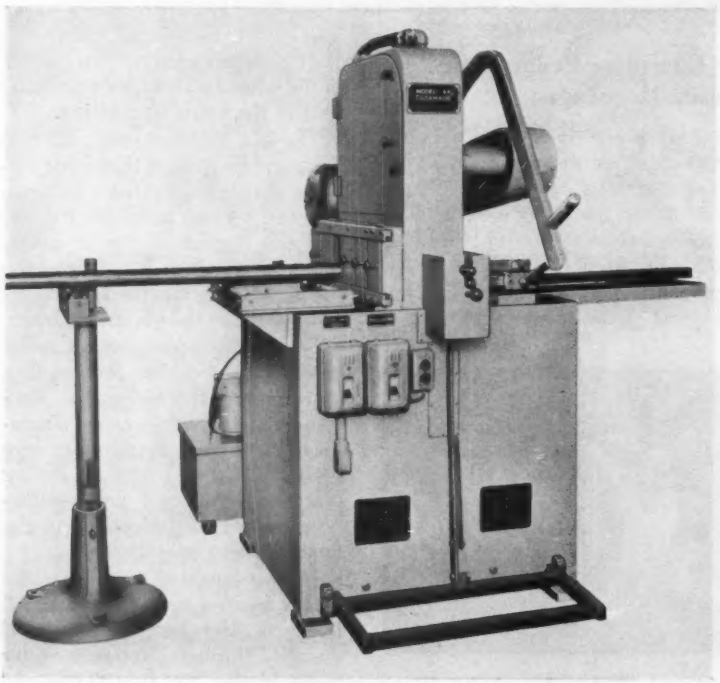
Circle Item 113 on postcard, page 263

Hot-Stamping Press

Phenolic plates with copper circuits are marked in color with circuit identification or assembly numbers in a new adaptation of the Model No. 9AS hot-stamping press announced by the Acromark Co., Elizabeth, N. J. This machine is provided with a preset counter for any desired number up to 1000. The machine then counts, marks, and ejects automatically all circuit plates placed in the magazine. The ejector, in turn, replaces the marked plates in another magazine, all in perfect numerical sequence. Production is at the rate of 3600 marked plates per hour. Continuous or intermittent operation is controlled by a hand-operated latch. The magazine has a friction drive, and the ejector is of the force feed type.

In actual operation, the plates to be marked are simply placed in the magazine; the counter is set for the correct number, and the hand-latch release is pressed. The machine then hot-stamps in color any desired lettering and consecutive number. A red light on the control box shows when the final count is reached. The control box also has a pilot light and switch for heater with control, a motor switch, and feeding circuit button. The pneumatic feeding unit is electrically operated from the ram.

Circle Item 114 on postcard, page 263



Campbell Model 64 oscillating "Cutamatic" cut-off machine

Campbell Cut-Off Machines and Allison Abrasive Wheels

The Campbell Machine and Allison Divisions of American Chain & Cable Co., Inc., Bridgeport, Conn., will jointly display cut-off machines and abrasive wheels at the National Metal Exposition in Cleveland. Many of the latest techniques in dry and wet abrasive cutting will be demonstrated.

The Model 64 oscillating wet abrasive "Cutamatic," shown in the accompanying illustration, will be demonstrated. This is a rugged machine, designed for rapid cutting of medium-sized bar stock making use of an oscillating motion. Equipped with a large-diameter Allison abrasive wheel—up to 18 inches for certain applications—it will sever sheets, angles, channels, pipes, tubes, and solids. This includes hardened or annealed steel, brass, bronze, Monel aluminum, magnesium, tungsten, tantalum carbide, beryllium, ceramics, phenolic plastics,

glass, and other materials. The swivel type vise can be rotated from 0 to 45 degrees for angular cuts. Furnished with a 10-H.P. motor, this machine measures 68 by 62 by 65 1/2 inches. The weight, with electrical equipment, is approximately 2000 pounds.

Also featured at the Show will be the Campbell Model 28 Sever-All dry abrasive cutter which is equipped with a 10-H.P. heavy-duty motor; the Model 481 oscillating wet abrasive cutting machine; and the Model 1A Nibbler.

The complete line of Allison cutting wheels to be displayed includes aluminum oxide types used for cutting steel and most other metals and alloys, and the silicon carbide types which are utilized for cutting glass, ceramics, plastics, building materials, and other non-metallic materials.

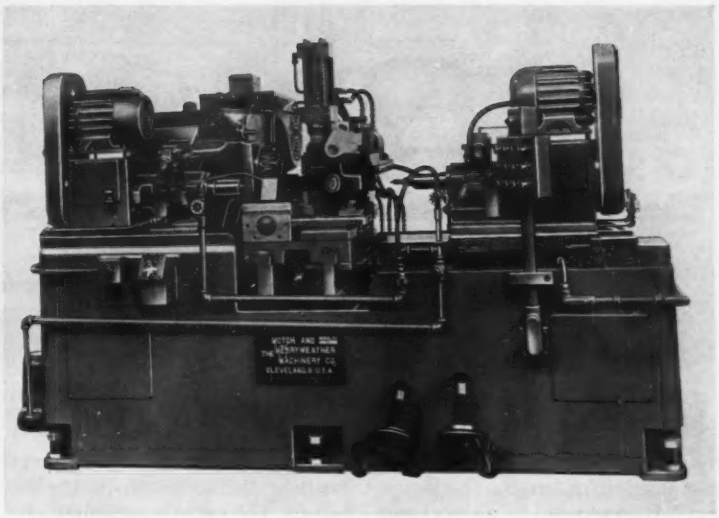
Circle Item 115 on postcard, page 263

Machine Equipped for Drilling Holes in Heat Exchanger Tube Sheets

The Michigan Drill Head Co., Detroit, Mich., has completed an ingenious production machine designed to drill all the holes in a tube sheet for a heat exchanger. The tube sheet, made of SAE 1020 boiler plate, is completely drilled in one setup. The machine will handle tube sheets from 8 inches in diameter and 1 1/4 inches thick to 54 inches in diameter and 2 inches thick.

This huge machine has a twenty-spindle, in-line drill head with fixed center, as shown in the accompanying illustration. It is built largely of standard Michigan components, including a Hydro twenty-column assembly mounted on a special base and a 60-inch hydraulic index-table, with a 180-degree indexing range, mounted on a 60-inch square spacing table. The spacing table permits fifty-seven-position spacing; forty-two from front to back; and fifteen from left to right. All positioning mechanisms are power-operated by means of selector switches. The machine is built to JIC hydraulic and electrical standards and has automatic lubrication throughout.

Circle Item 116 on postcard, page 263

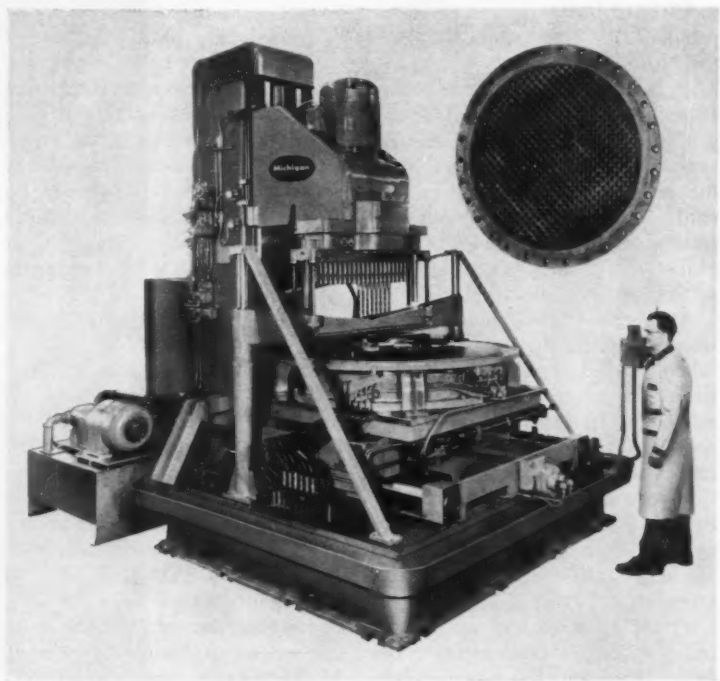


Motch & Merryweather truck steering knuckle processing machine

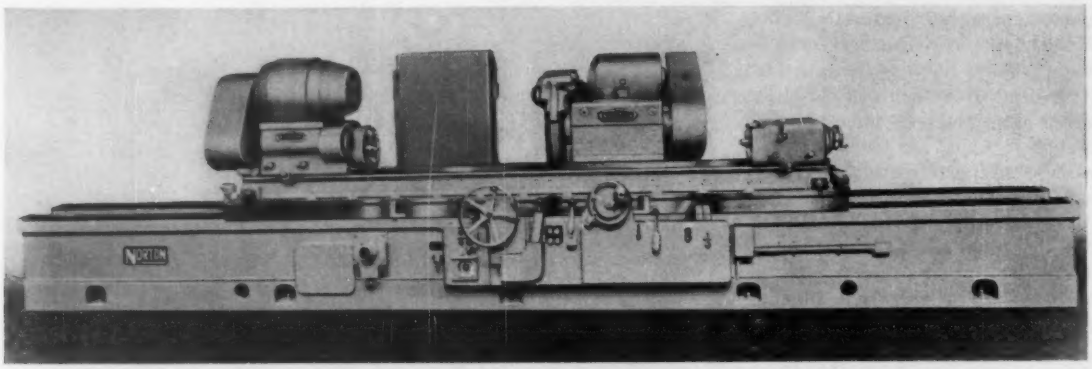
Machine for Milling and Centering Truck Steering Knuckles

The Motch & Merryweather Machinery Co., Cleveland, Ohio, has built a universal milling and centering machine designed to handle truck steering knuckles in a complete range of sizes. The part forging has a shank end that must be milled to length and aligned with the center between the protruding bosses of the flange at the opposite end. The part is manually loaded in a fixture on a movable table where it is automatically equalized radially in self-centering jaws that grip the stem end.

A hydraulically actuated locating arm swings down between



Special machine built by Michigan Drill Head Co. for use in drilling heat exchanger and condenser tube sheets



Heavy-duty, cylindrical grinding machine brought out by the Norton Co.

the bosses to move and locate the part forging for length. The flange end is then secured by a top clamp and the end locator retracts. The fixture table traverses to the milling head fixed on the base at the left of the table. The stem end is then milled, and the table returns to the starting position. The center drill unit, fixed on the base at the left side, drills by hydraulic quill feed. The same type of unit, on the right side, is mounted on a saddle that traverses to the feed position between the protruding bosses. The cycle is automatic, including unclamping when the machining operations are completed.

The milling head is a single-speed, heavy-duty production unit. The drill units are of the single-speed, hydraulic quill feed type. Production averages 90 to 120 pieces per hour at 100 per cent efficiency.

Circle Item 117 on postcard, page 263

Norton Heavy-Duty Cylindrical Grinding Machines

A line of heavy-duty cylindrical grinders has been announced by the Norton Co., Worcester, Mass. The 14-inch, Type C-2 and the 18-inch, Type LC-2 cylindrical grinding machines are designed to handle work-pieces weighing up to 6500 pounds on centers. All controls for feeds and speeds are located on the front of the machine to save time, particularly in setting-up operations.

Another feature is the combination graduated handwheel for the wheel feed and "click-count" indexing mechanism. This handwheel continually indicates the amount of infeed as the wheel rotates past a fixed pointer. The indexing mechanism permits settings in increments of 0.0001 inch of work-diameter reduction to be made instantly and without visual attention.

Preset table truing and grinding speed arrangements are other time- and labor-saving features. Table speeds for truing and grinding are independently adjustable and preset. Either speed is immediately obtained thereafter by movement of a combination selector and table start-stop lever.

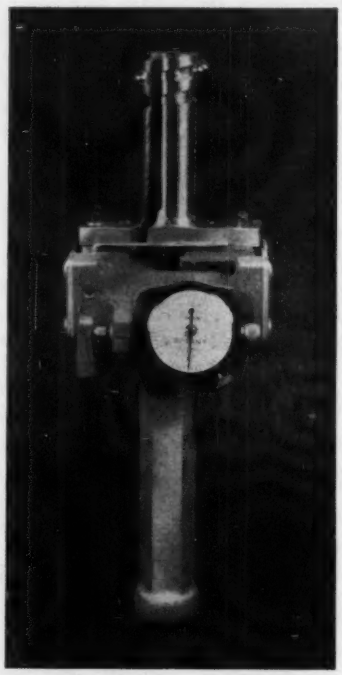
Other features include a centrally located work-jogging lever; automatic or manual control of work rotation and coolant flow by setting a selector switch; automatic adjustable wheel feed at table reversals with automatic wheel-head resetting; and separate dwell controls for each end of table reversal.

Table drive by hydraulic power is available from 2 inches to 240 inches per minute. The pressure-lubricated wheel-spindle bearings provide maximum rigidity and resistance to grinding pressures. With its minute oil-clearance requirements, this unit has all-round efficiency, in that it meets demands for critical finish or does heavy roughing jobs without bearing or oil pressure adjustment. Metal-to-metal contact in all feeding mechanisms produces fast spark-out and enduring precision. Both of these machines are available as plain type grinders or as semi-automatics.

Circle Item 118 on postcard, page 263

Ball Thread Segments for Thread Gage

Internal ball thread segments for checking the size of internally threaded circulating ball nuts have been developed by the Bryant Gage & Spindle Division, Bryant Chucking Grinder Co., Springfield, Vt. These segments are used with the Bryant No. 21 portable



Internal ball thread segments for Bryant portable thread gage

thread gage. Each segment carries three balls located adjacent to each other in a helical groove corresponding to the pitch of the internal ball thread to be checked. The balls in opposite segments are located 180 degrees apart, giving a direct reading of diameter and providing a quick, positive centering action.

The circulating ball nuts checked are used in ball-bearing screw assemblies for the actuation of landing gears, power steering, and similar applications.

Circle Item 119 on postcard, page 263

Delta Turning and Spinning Lathe

A 12-inch gap-bed, cabinet model lathe for wood turning, metal spinning, and turning of light metals, incorporating features developed to provide maximum safety, durability, and versatility, has been introduced by the Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. This lathe offers an infinitely variable speed range from 340 to 3200 R.P.M. It has a capacity of 38 inches between centers, 12-inch swing over the bed, and 16 1/2-inch swing over the gap for stock up to 3 1/2 inches thick, and is adaptable to polishing, sanding, fluting, and reeding, as well as all inboard and outboard turning operations. More than fifty accessories are available.

An easy-to-read, graduated speed indicator permits quick setting to the proper speed for each job by means of a conveniently located handwheel. The specially designed tailstock has a quick-acting cam clamp for rapid positioning and secure locking to the bed. The tailstock ram is nonjamming, releases automatically, and is graduated in 1/16-inch increments. Retracting the No. 2 Morse taper ram automatically ejects the centers.

The conveniently located push-button switch has protruding stop and shrouded start buttons for quick, safe operation. A heavy steel cabinet base encloses the drive mechanism, making it impossible for the operator to accidentally come in contact with V-belts or other moving parts. The outboard end of the spindle is threaded for mounting a faceplate to permit outboard turning.

Circle Item 120 on postcard, page 263

Duplex Burr-Master for Deburring and Chamfering Both Sides of Gears Simultaneously

A two-station, Duplex Burr-Master designed for the simultaneous deburring and chamfering of both sides of gears or splines is announced by the Modern Industrial Engineering Co., Detroit, Mich. Both stations can be used for deburring and chamfering the same size and type of gear or spline, or different parts can be handled by each station.

The output rate at each station is up to five teeth per second for spur gears, helical gears, and straight-sided or involute form splines. The Model BMED-24

Gap-bed lathe introduced by Delta Power Tool Division, Rockwell Mfg. Co.

Model BMED-24 Duplex Burr-Master built by Modern Industrial Engineering Co.

Duplex has a work range from 0.625- to 6.5-inch pitch diameter, with Model BMED-29 handling work from 3.0- to 9.5-inch pitch diameter. The machines weigh 3500 and 3900 pounds, respectively.

The entire tooth form, including the root of both sides of gears or splines, is completely deburred and chamfered on this machine, utilizing the patented Burr-Master cutting action. Depth of chamfer is infinitely adjustable to meet the production requirements of a particular gear or spline. The work cycle is automatic, and an electric clutch stops the machine with cutters withdrawn for loading and unloading. Separate motors and controls are supplied for each work-station, permitting maximum flexibility in operation.

Fixtures are so designed that they can be replaced with other tooling when production must be shifted to a new gear or spline. A complete change-over for any work-station can be accomplished in about fifteen minutes. Resharpening tools is equally simple. Only the cutter-locating face of the dovetail form tools has to be ground. Relief grinding is not necessary, making it possible to get up to several hundred grinds per tool. After grinding, the cutter is located in the holder by being brought up against a stop.

Circle Item 121 on postcard, page 263

Pull-Down Broaching Machine

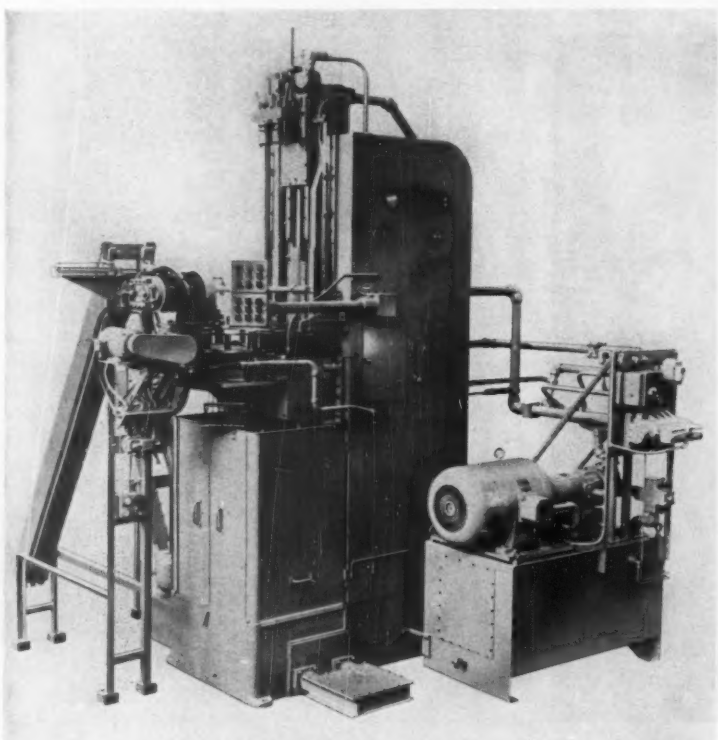
A pull-down broaching machine has been built by the American Broach & Machine Co., Ann Arbor, Mich., to provide maximum tooling flexibility and easy maintenance in vertical, internal broaching applications. This machine is electrically controlled, and all components are interlocked to provide continuous automatic operation.

All hydraulic systems are self-contained and located outside the machine column to facilitate maintenance. The unobstructed face of the heavy-duty column allows a wide range of tooling adaptation. A large work-table provides rigid support with minimum deflection for simple tooling, as well as for the dial index type unit shown in the illustration. Hinged splash guards under the table give clear access to the broach puller assembly and coolant sump.

This machine can be equipped with radially locked pullers, hydraulically actuated and electrically interlocked to the machine cycle. The fixed main cylinder is constructed to operate a massive slide traveling on hardened and ground rectangular ways in the machine column. The retriever unit is mounted integral with the main slide and on its own set of hardened and ground ways, providing perfect broach-alignment support through the major portion of the broaching stroke. The retriever bracket is hinge-mounted for easy broach removal. Provision is made for the adaptation of a chip conveyor, loading conveyor, and work ejector for installations demanding fully automatic operation.

The particular machine adaptation shown is an American PD-5-25-54, 25-ton, 54-inch stroke vertical hydraulic internal pull-down broaching machine, tooled for broaching the 1 1/2-inch inside diameter of 5 9/16-inch long steel sleeves, two at a time. The index unit on this machine has eight stations—four two-station work-holders and four two-station broach return passages. With a 24.0-second cycle at 100 per cent efficiency, production is 300 per hour.

Circle Item 122 on postcard, page 263



Broaching machine brought out by American Broach & Machine Co.

"Soundscope" for Measuring and Analyzing Industrial Noise

An electronic instrument called the "Soundscope," developed for use in solving industrial noise problems, has been announced by the Mine Safety Appliances Co., Pittsburgh, Pa. The instrument is said to be the first to combine in a single, portable unit the equipment needed to perform the four principal functions necessary for accurate measurement and analy-

sis of industrial noise. Acoustical engineers, safety directors, industrial designers, and many others concerned with the noise problem can use the instrument to advantage in tracking down and measuring hazardous noises.

In addition to its use in noise abatement programs, the instrument can be of help to manufacturers in eliminating undesirable sounds from autos, household appliances, and other products having moving parts that cause noise. Municipal authorities also can use it to check compliance with noise ordinances.

Circle Item 123 on postcard, page 263

"Hopperal" Parts Feeder

Automatic feeding of small production parts is being accomplished efficiently with a sliding-action hopper feeder, sold under the trade name of "Hopperal." This feeder provides a gently oscillating motion that is said to work fast and effectively with a minimum tumbling of the parts. The feeder is a product of Haberstump-Harris, Inc., Detroit, Mich. It was designed and developed to solve an automation problem in the automotive field and is now finding many other uses in industry.

In operation, the feeder selectively arranges bolts, nuts, screws, nails, rivets, and other types of small fasteners and parts on an internal track, permitting them to file out in an orderly manner to the outside feed track and down to any required position. A selector gate rejects pieces not properly positioned, allowing only those correctly positioned to flow to the "feed" track outside the hopper.

The feeder can be equipped with single or multiple tracks and can be designed to feed two different parts from the same hopper and to release a given number of pieces at a controlled rate of speed. It can be used to feed parts to processing machines, assembly machines, packaging machines, and many other industrial devices.

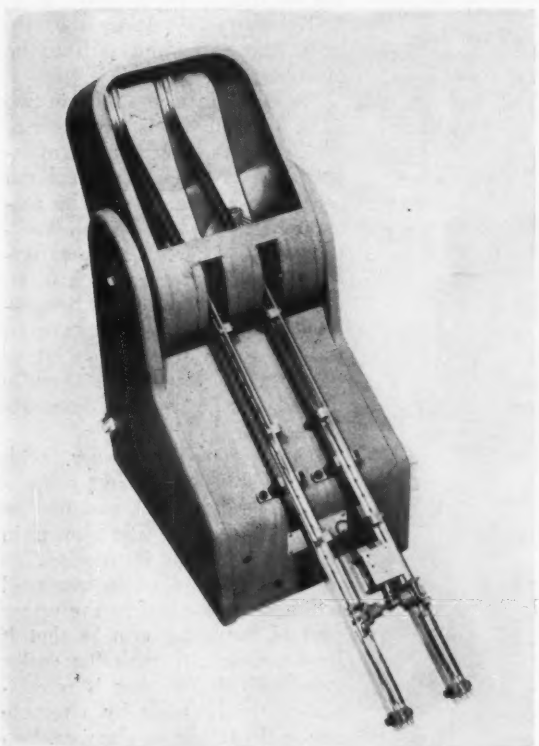
Circle Item 124 on postcard, page 263

Feedall Elevating Transfer Conveyor

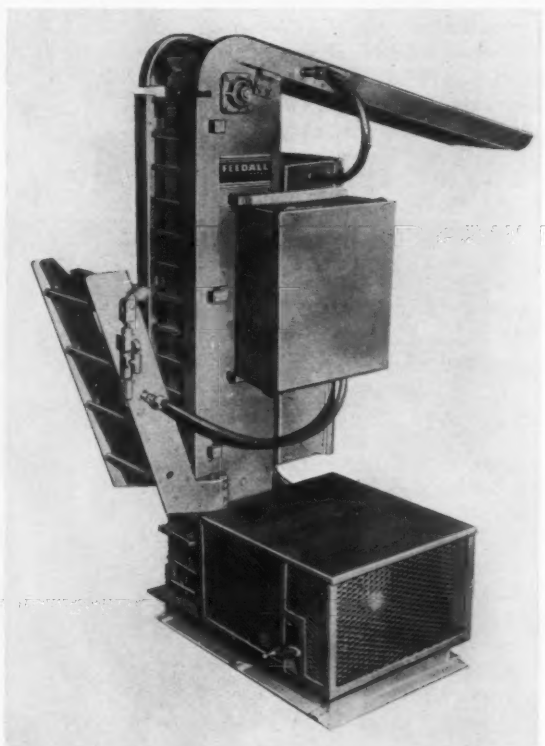
A special Model 4000 elevating transfer conveyor, designed to transfer long cylindrical parts from one production machine to another, is being manufactured by Feedall, Inc., Willoughby, Ohio. This conveyor accepts parts in a rolling position from the discharge chute of the first machine, elevates them, and delivers them to the magazine of the next machine. The conveyor operates at a delivery rate adjusted to suit the speed of the second production machine and is equipped with a control which shuts off the first machine in the event that it feeds too fast.

The conveyor will handle cylindrical parts from 3/8 inch to 1 1/4 inches in diameter and up to 12 inches long. Power is furnished by a 1/4-H.P., 220- or 440-volt motor through a variable-speed drive. This unit can be modified to meet the individual requirements of the user.

Circle Item 125 on postcard, page 263



Automatic feeder for small parts made by Haberstump-Harris, Inc.



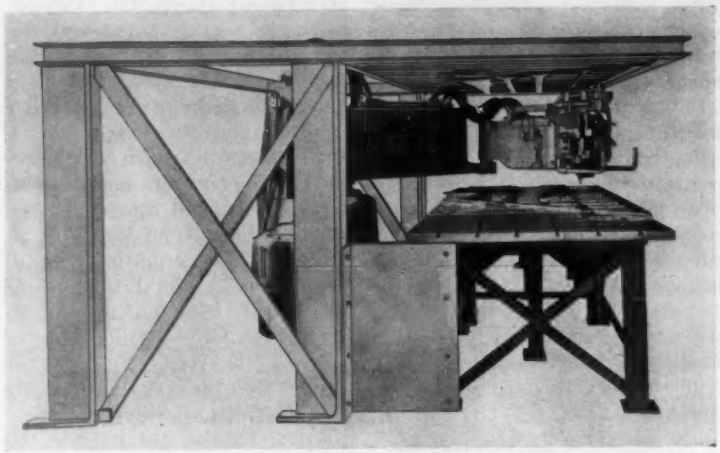
Elevating transfer conveyor manufactured by Feedall, Inc.

Detroit Automatic Broaching Machine

The Detroit Broach & Machine Co., Rochester, Mich., has brought out a hydraulic broaching machine that broaches a radius groove in both ends of two pinion gear blanks of different lengths at the rate of 2080 pieces per hour. The operation of this machine is fully automatic. The blanks are loaded into hoppers on each side of the machine, positioned and loaded into feed magazines by vibration, pushed through stationary broaches by twin pushers attached to the hydraulic press ram, and unloaded automatically into ejection chutes.

Hopper loading can be done automatically, and the machine will stop if the hoppers are empty. Electrical and hydraulic systems conform to JIC standards and are entirely self-contained. The machine is extremely compact, taking up a space approximately 9 feet wide by 4 feet deep by 5 feet high.

Circle Item 126 on postcard, page 263



Ekstrom-Carlson radial arm depth and contour mill with overhead canopy type template holder

Ekstrom-Carlson Radial Arm Depth and Contour Mill

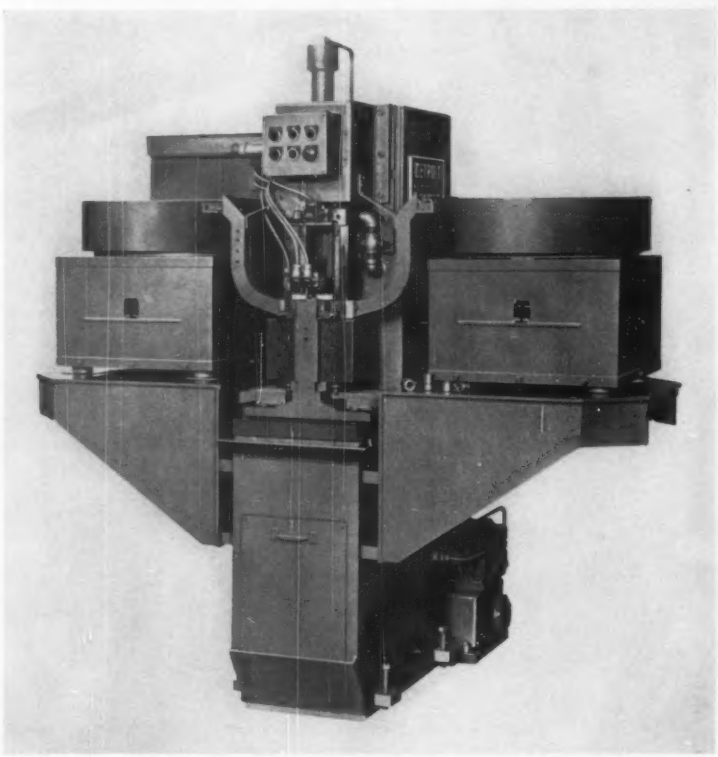
Ekstrom, Carlson & Co., Rockford, Ill., has announced two machines adapted for rapid production of large aircraft parts that have to be machined from thick plates of aluminum. These machines have high-speed spindles for form milling and routing.

The basic depth and contour mill consists of a heavy column-like base carrying a sturdy, jointed, radial arm. At the end of the arm is mounted a high-cycle, high-speed, direct-drive cutter motor which is available with adjustable speeds as high as 14,000 R.P.M. and as low as 3600 R.P.M. A T-slotted table under the arm holds the aluminum slab to be machined.

These machines are built in two sizes. The No. 480 is the larger of the two, with a maximum arm extension of 120 inches from column center to spindle center. This machine has a 60- by 120-inch worktable. The No. 484 is smaller, having a maximum arm reach of 60 inches and a 30- by 60-inch worktable. The pivoted arms have an extensive swing at each joint so that the cutter can be easily moved over and beyond the worktable area.

An optional accessory with either machine is a canopy structure on which can be mounted an overhead template, as shown in the accompanying illustration. To use such a template, an overhead follower is attached to the upper part of the outer arm so that it lines up directly with the cutter spindle. This follower is retractable and adjustable by a remote control hydraulic mechanism. Follower inserts can be selected to match cutter sizes.

Circle Item 127 on postcard, page 263



Broaching machine brought out by Detroit Broach & Machine Co.

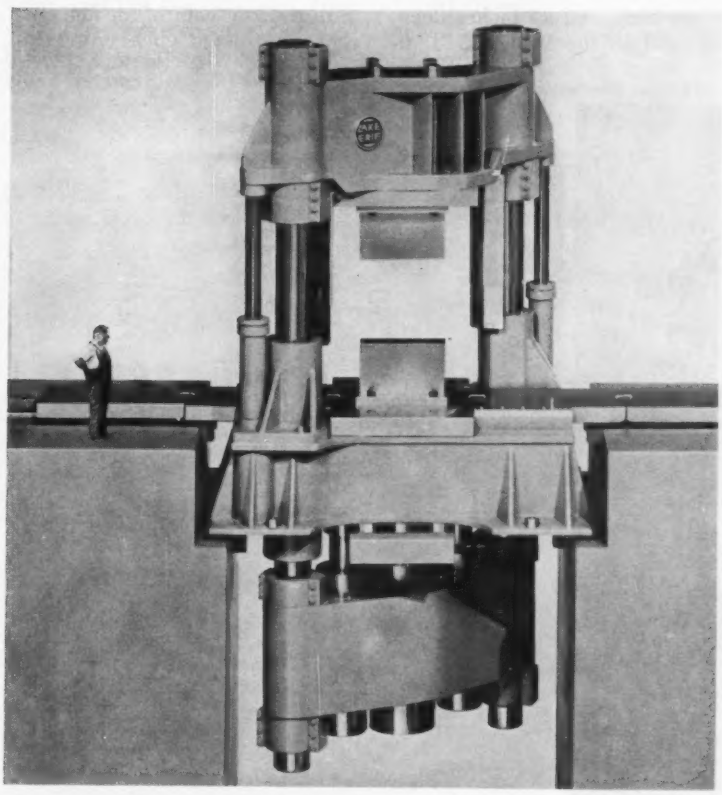
Lake Erie Hydraulic Forging Press

A 2000-ton self-contained hydraulic forging press has been built by the Lake Erie Engineering Corporation, Buffalo, N. Y., for the Allegheny Ludlum Steel Corporation. This single-action press is of the pull-down, two-column design and operates at the rate of 60 planishing strokes or 30 forging strokes per minute.

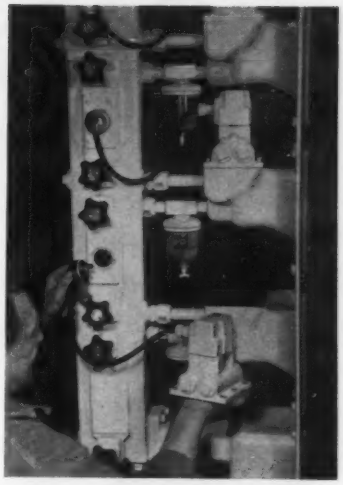
The clearance between the shields which protect the columns of the press is 48 inches front to back and 90 inches left to right. The maximum working stroke is 72 inches, with 120 inches maximum daylight capacity between the top and bottom bolsters. The center cylinder and the two side cylinders governing the pull-down action are inserted in the lower cross-head. Two cylinders inserted in the bed platen interact with the pistons coupled to the upper cross-head for push-back action.

Twenty pumps, each having a capacity of 34.9 gallons per minute of turbine oil at a pressure of 4420 pounds per square inch, are driven by ten double-end, 150-H.P. motors operating at 1200 R.P.M. The bed of the press is equipped with a movable die slide which is powered by a hydraulically operated gear and rack arrangement. The slide, which consists of six 7-foot long coupled units, travels through a distance of 24 feet and constitutes the lower bolster. Controls for the press are mounted on a stainless-steel console adjacent to the press. The height of the press above the floor is 19 1/2 feet and the depth below the floor is 15 feet.

Circle Item 128 on postcard, page 263



Self-contained 2000-ton hydraulic forging press built by the Lake Erie Engineering Corporation



Clearing automation air manifold for auxiliary press equipment

Air Manifold Control for Clearing Presses

An automation air manifold designed to provide solenoid-controlled air pressure for the operation of auxiliary equipment, such as coil feeders, unloaders, die lifters, stock dopers, and other devices used with its power presses, has been brought out by the Clearing Machine Corporation, Chicago, Ill. This compact unit takes the place of the elaborate network of piping and fittings formerly required to install auxiliary equipment. When a Clearing press equipped with an automation air manifold is used, only two simple connections are required to complete an installation of auxiliary automation devices—one air inlet and one exhaust. The rest of the air circuits have been engineered into functional castings.

The only other devices required to operate automation equipment are the adjustable rotary cam limit switch and timing relays. This complete automation package can be incorporated in the press.

The automation manifold is mounted in its own separate compartment. Air controls requiring adjustable pressures are mounted in an adjacent compartment. Separating these two types of controls simplifies the pneumatic system and prevents tampering with press control settings.

Exhausts from normal operation of the solenoid valves are directed to a single port at the bottom of the manifold. They are then piped to an air silencer, located in a lower compartment of the press, or to the basement.

Circle Item 129 on postcard, page 263

Automatic stud driver introduced by the Syracuse Special Machine Co.

Automatic Stud Driver

To meet the demand for a smaller version of its six-head and twelve-head automatic stud drivers, the Syracuse Special Machine Co., Inc., Syracuse, N. Y., has introduced the Model SD10-2 unit which can be easily adapted for use with from one to three heads. The heads can be changed to different patterns by using new spacer bars made from factory drawings. Since the heads can be spaced as closely as 2 1/2 inches center to center, they are easily integrated into automated index-tables or conveyor lines, such as the Syracuse special pallet transfer machine.

Heads are individually driven by 1/4-H.P. alternating- or direct-current motors or air torque, and are fitted with air-hydraulic or hydraulic connections. Units are equipped with a JIC unit type electrical cabinet, vibratory four-track stud hopper, and either air-hydraulic or self-contained electric-hydraulic unit. Self-opening, positive-drive chucks grip and release the studs.

Circle Item 130 on postcard, page 263

"Lapmaster" Stand with Storage Space

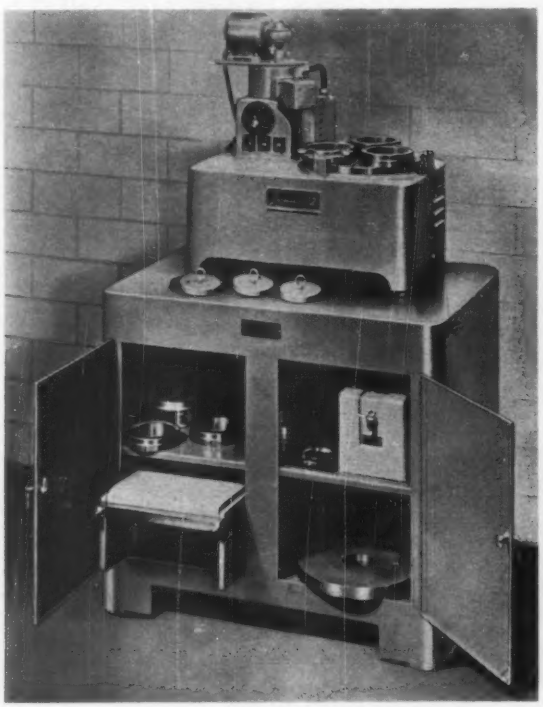
A stand 36 inches wide, 32 inches high, and 24 inches deep, designed for the Model 12 "Lapmaster" lapping machines, is now available from the Crane Packing Co., Morton Grove, Ill. The stand is for use with either new machines or those already in use. It serves as a convenient and space-saving work-table, and also provides handy inside storage space for compound, vehicle, polishing stand, monochromatic light, etc.

Sides of the stand are 12-gage steel, and the top, 1/4-inch steel plate. Welded construction is used throughout. Two steel doors with locks, mounted on piano type hinges, give access to the two-shelf inside storage compartment. The stand weighs 200 pounds.

Circle Item 131 on postcard, page 263

Direct-Current Rectifier Type Welder

A direct-current, rectifier type welder with "Diverter Path" control is announced by Hobart Brothers Co., Troy, Ohio. The case has easily removable side panels. The recessed control panel has a polarity reversing switch and three coarse current adjustments with rheostat control for fine current adjustments. The rheostat can



Stand with storage space for "Lapmasters"

Hobart direct-current, rectifier type welder

be removed for remote control. The welder has both thermostatic and current overload protection. A magnetic line contactor is supplied at no extra cost. The unit is available in 300- and 400-ampere models.

Circle Item 132 on postcard, page 263

Morris Unit Type Machine for Processing Refrigeration Compressor Housings

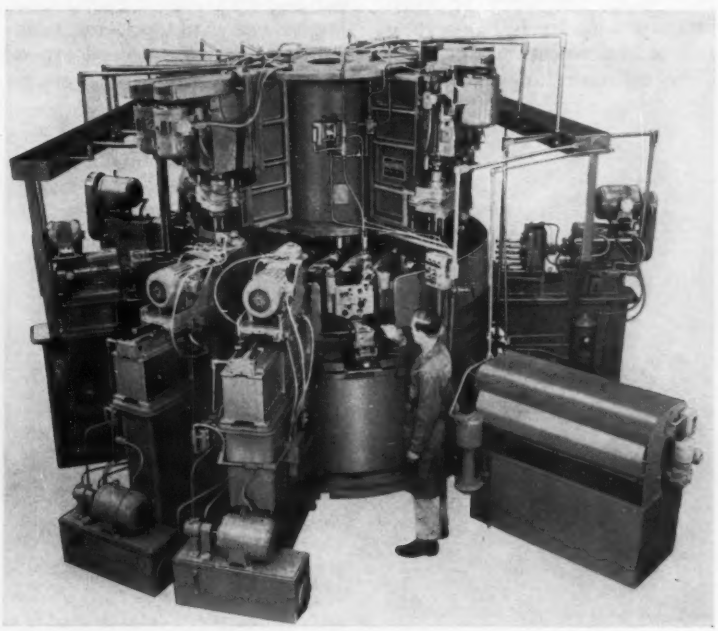
Forty-seven operations are performed automatically on one- or two-cylinder refrigeration compressor housings by a high-production machine manufactured by the Morris Machine Tool Co., Cincinnati, Ohio. This Model 334-S unit type, 18-station machine utilizes an 84-inch diameter table to process 120 parts per hour. Model change-over problems are simplified by incorporating standard Morris production units mounted on a basic center column equipped with an 18-station hydraulic indexing table.

The forty-seven spindles are mounted on three 8-inch way type units; six No. 2 Cam-Matic drill units; and eight Air-Oil-Matic drill units. They are used to mill, drill, counterbore, spot-face, bore, ream, and tap the housings. The unit type construction permits fast, easy realignment of the machine for product model changes.

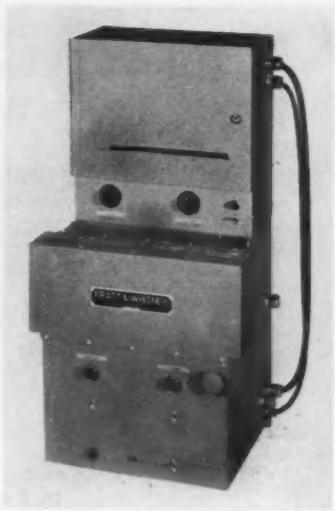
Operation is completely automatic, unfinished pieces being loaded into air-powered clamping fixtures and completed parts removed every thirty seconds. The fixtures, which accommodate either one-cylinder or two-cylinder housings, utilize an expanding arbor to locate the part with respect to a previous roughing operation. Each drill unit has independent feeds and speeds, permitting adjustment without affecting the entire machine. Preset for correct alignment, the individual unit performs the same operation each time the table indexes. All units are controlled simultaneously through an integrated electro-hydraulic system.

An electric clutch simplifies construction and prevents damage to work-piece or tool by slipping when the thrust becomes excessive.

Circle Item 133 on postcard, page 263



Automatic machine for processing compressor housings made by the Morris Machine Tool Co.



Recording analyzer developed by the Pratt & Whitney Co.

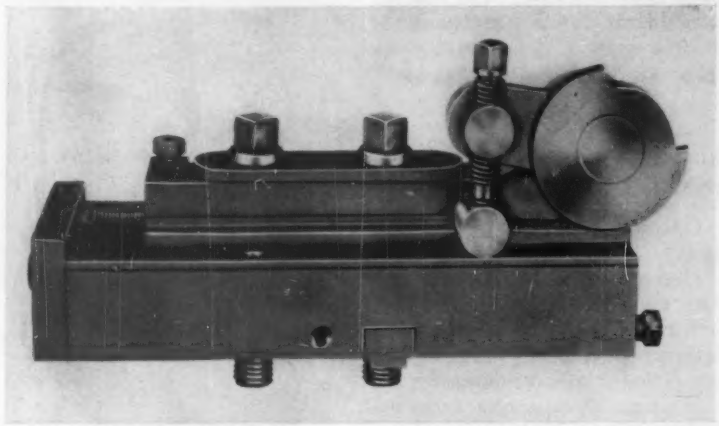
Rolled Strip Metal Analyzer That Prints Record Cards

A production analyzing totalizer that prints a card record of the on-gage and off-gage footage of rolled strip metal produced by a rolling mill is announced by the Gage Division of the Pratt & Whitney Co., Inc., West Hartford, Conn. The analyzer unit, operating in combination with either contacting or non-contacting continuous strip thickness gages, prints a permanent record in numerical rather than chart form—a feature that provides accurate record-keeping for analysis and for later shearing operations.

A typical installation on a finishing mill will accumulate undersize, on-gage, over-size, and total footage records of a coil on the last pass through the strip mill. At the end of the pass the operator inserts the standard production work card in the printer, and these footages as well as the time, the date, the coil number, the operator's number, and sets of tolerance zones are imprinted for the permanent record. During this operation the counters are automatically reset for the next coil.

The card printer is actuated by the company's Model D classifying control, which is used in conjunction with a contactor pulsed by the mill drive.

Circle Item 134 on postcard, page 263



Tool-holder for use on multi-spindle automatics announced by R and L Tools

Cross-Slide Tool-Holder for Multi-Spindle Automatics

R and L Tools, Philadelphia, Pa., has brought out a versatile tool-holder for multi-spindle automatics. This tool can be used on either the front or rear cross-slide of multi-spindle machines and is made for circular type tools.

Circle Item 135 on postcard, page 263

Whitney-Tormag Flexible Magnetic Drive

The Whitney Chain Co., Hartford, Conn., has completed licensing agreements with Tormag Transmissions, Ltd., Vancouver, B. C., Canada, covering the manufacture of a new product line, consisting initially of magnetic drives and ultimately including variable-speed speed reducers. The agreement gives Whitney Chain Co. the exclusive marketing rights for these magnetic power transmission products in the United States and Canada.

The Whitney-Tormag magnetic drive provides a flexible slip type drive between a motor and its load in a range from fractional horsepower to over 50 H.P. This drive consists essentially of two component parts—a magnetic rotor, which is a cylinder to which are attached strong Alnico V permanent magnets; and a bimetallic rotor, which is a copper-faced, mild steel plate or cylinder perforated with steel rivets.

In basic form, these two rotors are mounted face-to-face with an air space between them. If either of the rotors is driven, a torque is induced in the other through eddy currents, with the permanent magnets supplying the necessary magnetic flux.

The driving and driven rotors are never in contact—the air gap always exists between them. This air-gap arrangement is said to give a shockless, vibration-free drive; eliminate wear and maintenance costs; and provide smooth pick-up for heavy, unbalanced or fluctuating loads. Efficiency at rated horsepower under full operating loads is 95 per cent.

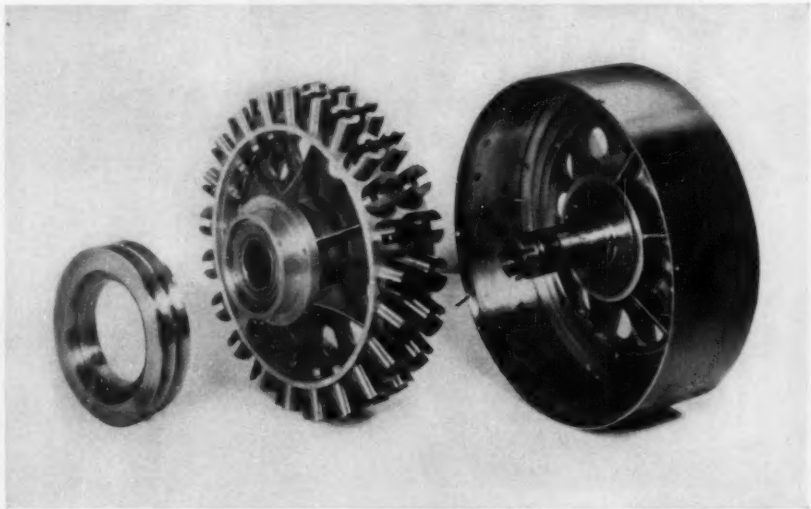
The cylindrical design of the Whitney-Tormag magnetic drive is adaptable to the new, smaller NEMA frame specifications and permits the Whitney-Tormag unit to be smaller in diameter than an electric motor of similar horsepower. Overload protection is provided for the driving motor, and the drive can be run in full stall or 100 per cent slip indefinitely without harming the motor or the coupling. A motor driving through a Whitney-Tormag unit can be instantly reversed under full load and used as a dynamic brake without harm to magnetic drive or motor.

Circle Item 136 on postcard, page 263

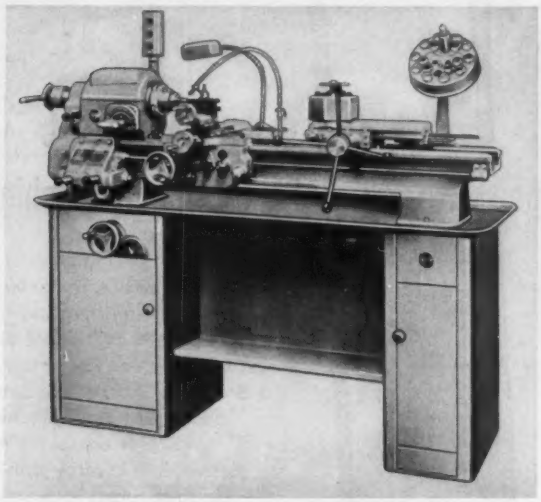
Delta-Rockwell Metal Lathe Used for Production Work

Four accessories designed to convert the Delta 11-inch metalworking lathe into a turret lathe have been announced by the Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. All four accessories, including a bed turret, turret toolpost, lever type collet closer, and coolant unit, fit both the 4- and 5-foot-bed models of the lathe.

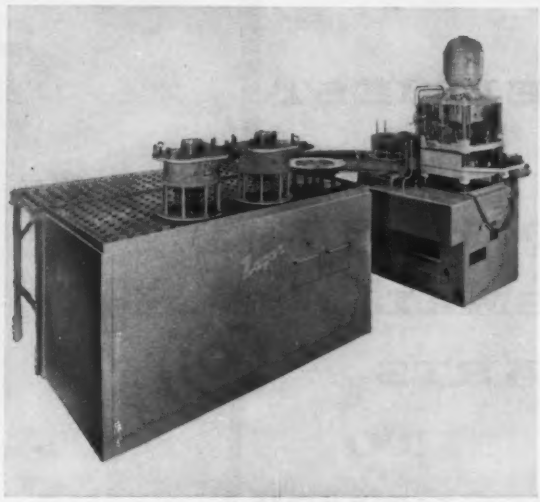
With these accessories, the lathe can be used on the production line for precision manufacturing, as well as in toolrooms, maintenance departments, and experimental departments as an engine



(Left to right) Power take-off collar, magnetic-driven rotor, and bimetallic driving rotor of Whitney-Tormag magnetic drive



Delta engine lathe converted to turret lathe by addition of accessories



Multiple-spindle drilling equipment brought out by Zagar Inc.

lathe. As modified by the accessories, the lathe is adapted for the manufacture of duplicate parts and for all primary and secondary machining operations.

Circle Item 137 on postcard, page 263

Automatic Gage for Measuring and Sorting Jewel Bearings

The tiny jewels used as nonfriction bearings in watches have a very precise bearing hole—0.008 inch in diameter. In order to produce accurate timepieces, it is necessary that the diameter of this hole be held to size within very close limits. Measuring the jewels by hand is a difficult, slow, and tedious job. They are too small for easy handling, and it is necessary to check several thousand a day to keep up with production.

Federal Products Corporation, Providence, R. I., has developed a high-speed, automatic electronic sorting gage that does the job with great accuracy and speed. This gage measures the holes in the jewels and sorts them into four acceptable categories, plus over and under size, at a speed of 1800 pieces an hour. The four acceptable classifications differ by 0.0001 inch.

When ready for gaging, the jewels are hopper-fed to a rotating table of the machine and carried to a chute leading to the gaging station. They are fed, one at a time, into the chute and then into the gaging position. With the hole in a vertical position, the gaging needle is inserted to take the measurement. The result is transmitted from the gage head to an electronic classifier which signals a rotating wheel containing the disposal cups so that the correct cup will be in position to receive the jewel.

Circle Item 138 on postcard, page 263

Zagar Multiple-Spindle Drilling Equipment

Changing, limited, and intermittent production work adaptable to multiple-hole drilling can be handled economically on a small four-post unit brought out by Zagar, Inc., Cleveland, Ohio. This unit houses 24-inch Zagar hydraulic drill heads, as shown in the illustration.

The basic unit is designed so that changing of heads and tool-

Automatic measuring and sorting gage for tiny jewel bearings made by Federal Products Corporation

EASIEST WAY TO GRIND SMALL PARTS TO "TENTHS"

the Brown & Sharpe No. 5 Plain Grinding Machine

Grinding the main bearing surfaces of sewing machine crankshafts . . . a routine job on the No. 5.

There is no easier, faster way to consistently grind small, duplicate cylindrical parts to 0.0001" or less, than on a Brown & Sharpe No. 5 Plain Grinding Machine (3" x 18"). It combines extra-convenient control with high-accuracy operation. For example: Operator can sit or stand comfortably, and easily handle *all* control and work . . . load, grind, and unload with the minimum of fatigue. Super-precision spindle construction minimizes spark-out time. Cross-feed handwheel automatically starts headstock and coolant when grinding wheel is advanced toward work, stops them when it is withdrawn — an extra aid to productivity. And, with optional Electralign Equipment, alignment control to 0.0001" on both straight and taper work is simple and positive. All the No. 5's machine movements are mechanical — simple, precise, troublefree. It's ideal for economical grinding of diameters up to 1", to close limits on a production basis. For full details, write Brown & Sharpe Mfg. Co., Providence, R. I.

Ask About Our Pay-As-You-Depreciate Machine Tool Plan

Brown & Sharpe *milling, grinding, and screw machines • cutters • machine tool accessories • precision tools • pumps*

ing can be performed easily. Each head is carried on its own loading basket, which is rolled on a conveyor and onto the roller table. The only other operation required to change the head is to remove and replace the bushing plates and locators.

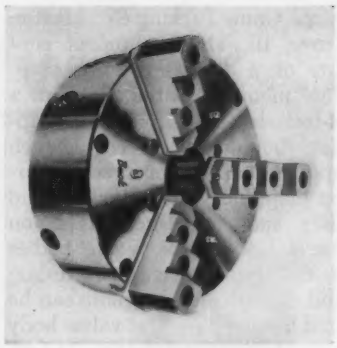
The roller table provides storage space for the heads in loading baskets as well as the empty basket for head being used in the drilling unit. Any number of heads appropriate to the drilling unit can be stored, thus making it possible to drill almost countless hole-patterns and any number of holes within a given area. Holes are drilled simultaneously by the heads. One head can drill holes of varying diameters in the same work-piece.

Circle Item 139 on postcard, page 263

Dustproof Chuck

The Buck Tool Co., Kalamazoo, Mich., will have on exhibition for the first time at the National Metal Congress and Exposition in Cleveland a dustproof chuck. It is claimed that the dustproofing mechanism does not interfere with the work-holding function of the chuck. This chuck is also said to be the only dustproof chuck with a hole through the center.

The chuck was developed for use on grinding machines and dividing heads, and wherever abrasive dust and metal chips are a problem. It provides the same



Buck dustproof chuck

precision as all Buck "Adjust-Tru" chucks and can be used for either dry or wet work.

Other chucks to be demonstrated at the Cleveland show include: "Adjust-Tru" standard chuck models; power chucks; independent jaw Meehanite chucks; and compensating power chucks.

Circle Item 140 on postcard, page 263

Push-Pull Tapper

A push-pull tapper unit of the instant-reversing, speed-reduction type, made expressly for tapping, is being manufactured by the Supreme Products Corporation, Chicago, Ill. This unit can be attached to any portable drill. The speed-reduction ratio of 7 to 1 in the driving direction gives the operator more than adequate power to tap in all materials. Instant reversing means that the direction of the tap can be reversed without stopping the drill motor. Thus, the operator can move the tap into and out of the hole at will. In case chip accumulation hinders the movement of the tap, it can be backed out a few turns and then advanced again without stopping the motor.

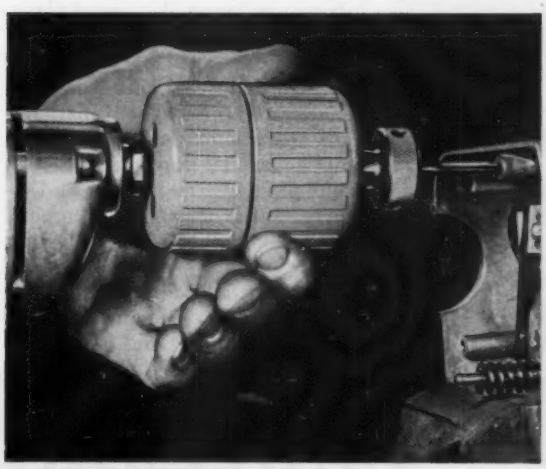
The housing of the unit is held in the fingertips, and any unusual strain is felt instantly. The tap stops when the fingers are released, and runs in reverse when the rear housing of the tool is held or gripped. This arrangement is said to virtually eliminate tap breakage. The tapper will handle all taps up to the 5/16-inch size, and the five necessary collets are included with the unit.

Circle Item 141 on postcard, page 263

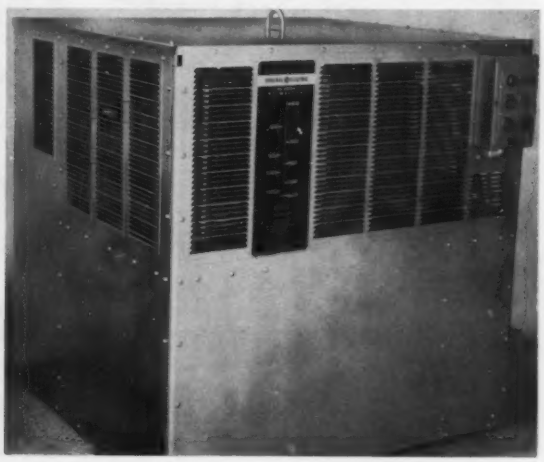
General Electric Rectifier Power Unit

A 1540-ampere rectifier power supply unit, rated for 100 per cent duty cycle for the submerged-arc process, has been announced by the Welding Department of the General Electric Co., Schenectady, N. Y. This rectifier is designed for operation on a three-phase, 460- or 575-volt input line (not reconnectable). The unit has an actual output range of 600 to 1600 amperes and can be operated continuously. Its volt-ampere characteristic limits the short circuit current.

The input voltage is stepped



Push-pull tapper made by Supreme Products Corporation



Rectifier power unit announced by General Electric Co.

down by a bank of three transformers of the moving coil design, and then rectified by a bank of selenium rectifiers. The coils are motor-driven to provide remote current adjustment.

The entire unit is cooled by two propeller type fans, powered by reversible, totally enclosed 1/3-H.P. motors. Reversing fans serve to reduce maintenance costs and lengthen rectifier stack life by cleaning accumulated dirt from leading edge of stacks. Coils, with Class H insulation, are rated for 130 degrees C. temperature rise. Open circuit voltage is 78 volts, and at full load the output is rated at 40 volts.

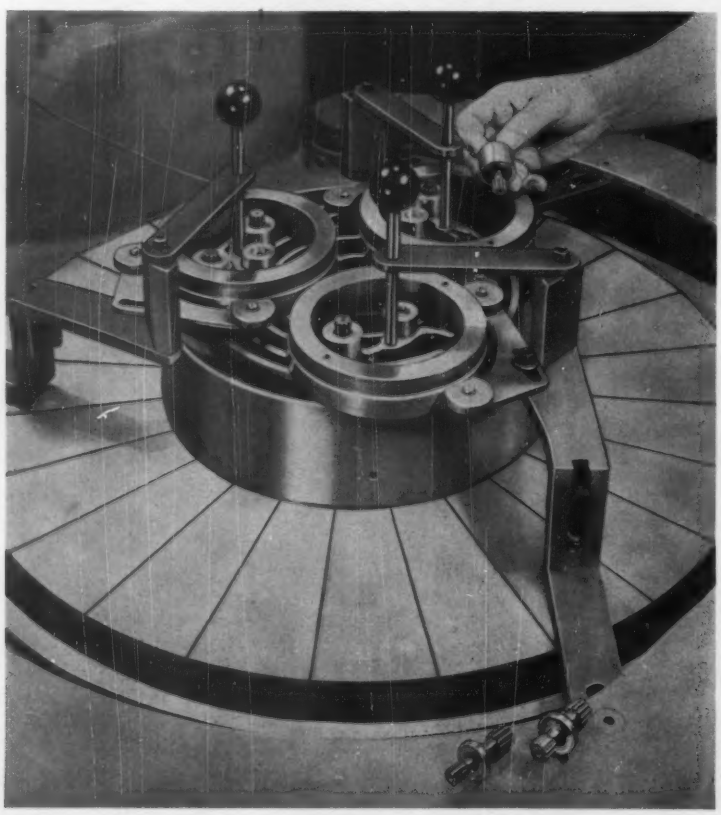
Circle Item 142 on postcard, page 263

Lapmaster Equipment for Lapping Shoulder Faces

Flat lapping of shoulder faces, as well as various other lapping operations, can be performed with Lapmaster equipment announced by the Crane Packing Co., Morton Grove, Ill. This equipment consists of a 12-inch grooved lap-plate mounted in the center of a 24-inch lap-plate for use in lapping shoulder faces. The 12-inch lap-plate can be removed to permit lapping valve bodies and discs such as those used on Diesel locomotives. Valve bodies of this type have a protruding stud. The 12-inch lap-plate can be used for lapping the valve body with the stud, while the 24-inch lap-plate with conditioning rings is used for compressor discs and other flat parts. The same tooling arrangement can also be supplied to fit the new 36-inch Lapmaster.

Lapmaster lapping machines are used to generate surface flatness to less than one light band and finishes to 2 micro-inches in short or large production runs. Typical applications are parts for engines, transmissions, adding machines, tool and die equipment, and quartz crystals.

Circle Item 143 on postcard, page 263



Lapmaster equipped for lapping shoulder faces

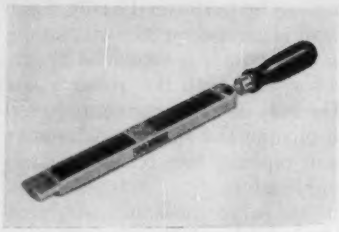


Fig. 1. Stanley "Surform" tool

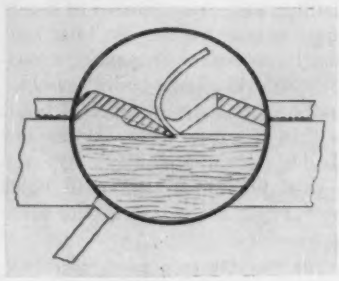


Fig. 2. Diagram showing action of teeth of tool seen in Fig. 1

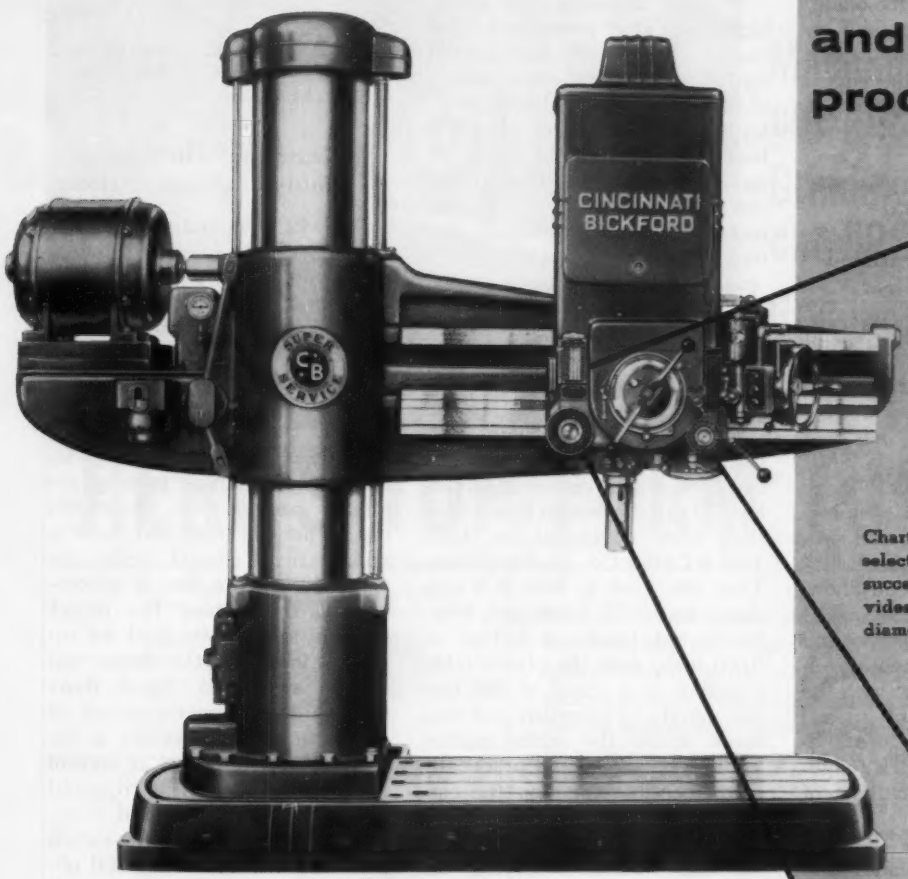
Stanley Tool for Forming and Finishing Metallic and Non-Metallic Materials

"Surform," a newly developed tool for forming and finishing all types of surfaces, is being introduced by Stanley Tools, Division of Stanley Works, New Britain, Conn. This tool works exceptionally fast when used like a rasp or file on all materials up to the hardness of mild steel, including wood, rubber, leather, fiberboard, plastics, copper, aluminum, lead, and other metals.

Two models of this tool, one shaped and used like a hand plane and the other like a rasp, shown in Fig. 1, are available for a wide range of industrial jobs. These include such applications as pattern-making; trimming-up castings and moldings; and finishing non-ferrous products. The tool is said to be especially efficient in roughing or finishing all non-ferrous metals and wood.

The cutting component of the "Surform" is a high-quality Sheffield steel unit having more than 450 separate razor-sharp blades. Each cutting edge has a 35-degree angle and a semicircular throat through which chips and shavings pass, as shown diagrammatically in Fig. 2. In effect, every blade func-

HEAD WORK... saves time ...controls and speeds production!



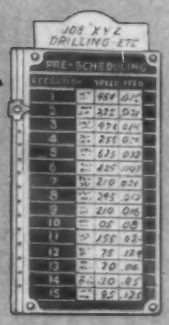
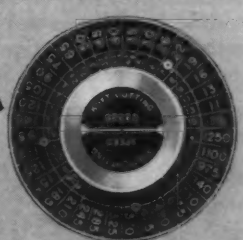


Chart guides the operator in pre-selecting speeds and feeds for succeeding operations. It provides a permanent record of tool diameter, speed and feed.

Hydraulically pre-selects all 18 feeds. Positive geared tap leads and feeds are quickly pre-set.



Hydraulically pre-selects all 36 speeds. Speeds and tool diameters are shown in large easy to read figures.

This NEW modern head gives an accelerated production and an increase in accuracy of performance ... the greatest advance in simple and positive control in Radial Drill history.

Two convenient direct reading dials control the automatic shifting of sliding gears. While the tool is cutting, merely set the dials to the speed and feed for the next operation. As the spindle is stopping for inserting the next tool, the shifting is done hydraulically ... directly, quietly and quickly. No other operations—no loss of time. Write for catalogs.

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tions like a miniature block plane. Because depth of cut is controlled by the sharp blades, only light pressure need be exerted on the tool.

Cuttings will not clog the blade, and it is said that when used on end grains of doors or plywood, the tool will not chip the edges. When the cutting strip is worn, it can be easily and inexpensively replaced.

Circle Item 144 on postcard, page 263

Starrett Color-Identified Hack-Saw Blades

A complete line of power and hand hack-saw blades, developed and production-proved in the Starrett metallurgical and production testing laboratory, has just been announced by the L. S. Starrett Co., Athol, Mass. These blades, together with a complete line of hand measuring and precision instruments, will be exhibited at the National Metal Show.

Starrett "Redstripe" SM special alloy, high-speed steel power and hand blades combine new developments in heat-treating with the long-wearing quality of special high-speed steel. They are specially tempered for extra toughness and high-speed cutting of hard materials.

Starrett "Greenstripe" Safeflex welded-edge power blades and hard-edge flexible backhand blades will be exhibited. The power blades are double welded to make them shatterproof, safer, straighter-cutting, and longer-lasting. They are particularly recommended for tough alloy steels, multiple cutting, or interrupted cuts. The hand blades combine a hard cutting edge and flexible back to make them virtually unbreakable.

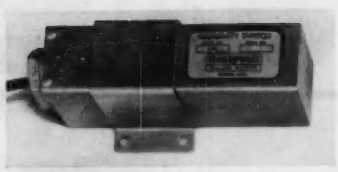
Starrett "Bluestripe" selected, high-speed steel power and hand blades are specially heat-treated for high-speed production sawing of hard-to-cut metals like high alloy steel, stainless steel, phosphor bronze, tool steel, rails, Allegheny metal, chrome steel, Monel metal, etc. These blades are also recommended for general-purpose cutting.

Circle Item 145 on postcard, page 263

Apex Tool-Holder and Carbide Tip

A special quick-change tool-holder for planers and a specially designed 2-inch diameter Carboloy 370 carbide button type cutter have been developed by Apex Tool & Cutter Co., Shelton, Conn. They are used to take 5/8-inch deep cuts on 12- by 48-inch Meehanite test blocks at a feed of 0.060 inch, with the planer table traveling at a speed of 300 feet per minute. A complete cut was made across the entire casting with no breakouts and practically no perceptible wear on the carbide tool. The straight, rear lock holder employed permits fast tool indexing without removing the holder from the planer clapper-box. Tool bits of other shapes, either with carbide tips or of high-speed steel can be changed in the holder without removing it from the machine.

Circle Item 146 on postcard, page 263



Magnetic switch developed by the Doelcam Division of the Minneapolis-Honeywell Regulator Co.

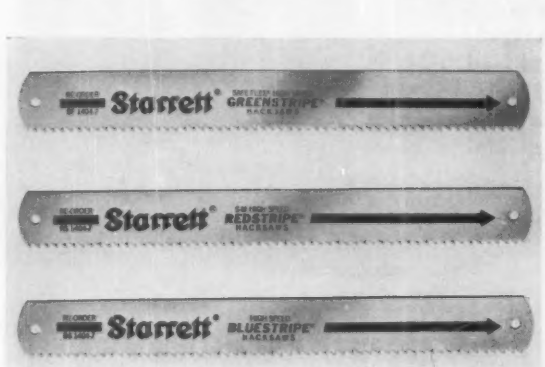
Magnetic Switch for Assembly-Line Automation

A switch, operating on the "proximity" principle, to keep tabs on moving metal parts has been developed by the Doelcam Division of the Minneapolis-Honeywell Regulator Co., Boston, Mass. This switch is said to work like a "magnetic detective" in locating objects containing iron which move on assembly lines; in liquids; and even the moving parts of automatic machine tools. The switch has no moving parts and there is no physical contact with the work-piece. Detection is accomplished by passing the object through a magnetic field set up directly in front of the sensing end of the switch. A signal flows through the magnetic circuit of the switch and operates a remotely located electrical control relay. This relay can be triggered up to ten times per second.

The sensing poles in the switch are designed to detect metal objects within one-eighth of an inch of its face. In the case of machine tool operation, the switch cannot be set off by falling metal chips. It operates on 115-volt current.

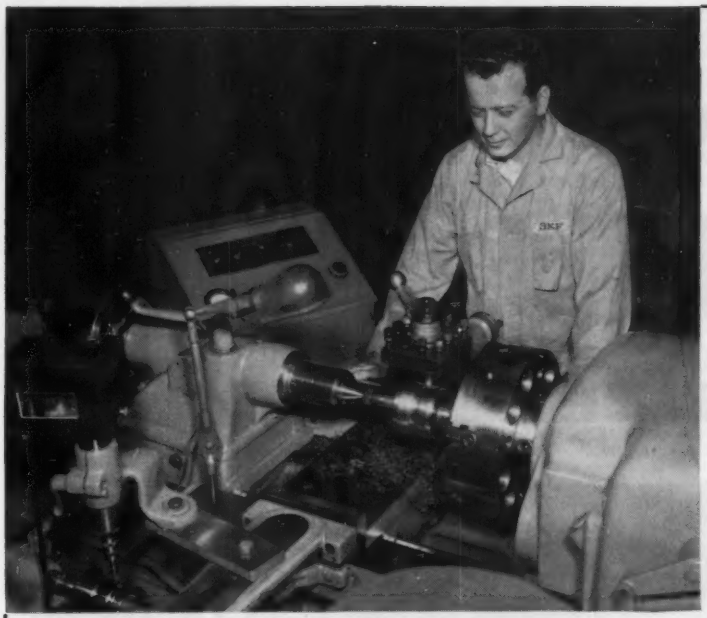
Circle Item 147 on postcard, page 263

(*This section continued on page 248*)



Hack-saw blades announced by the L. S. Starrett Co.

Quick-change tool-holders made by Apex Tool & Cutter Co.



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Grinding wheel cost—cut 25%!

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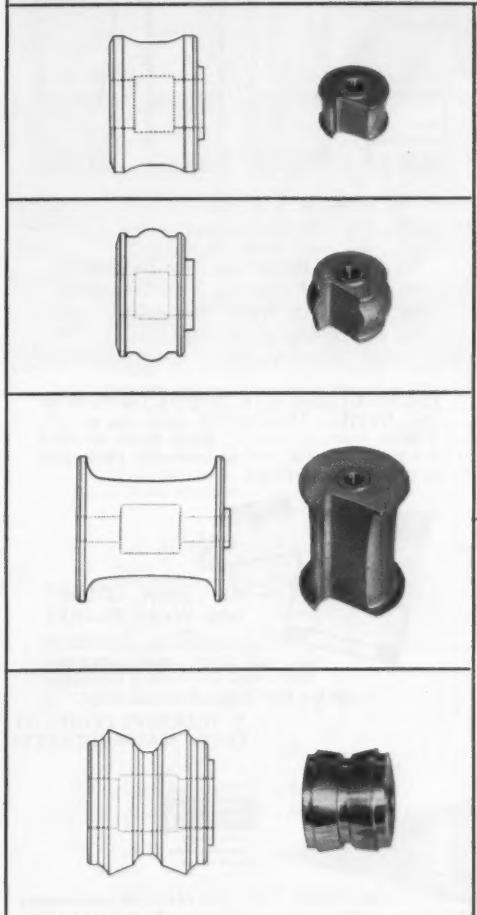

Wouldn't you welcome savings like these? S. K. F. Industries, Inc. does, and their happy secret is shown above in an action shot of their Monarch 16" Series 61 Lathe with Keller controls turning circular form tools from the solid. The figures contrast present against previous production on conventional machines, so widely and wastefully used for this work.

Point is, instead of leaving large amount of stock for final grinding, S. K. F. finds that accuracy of new Monarch with Keller controls enables them to turn and shape directly from the solid within about .0005" of finish size. And less-skilled operators can machine them faster—before less grinding.

You can't miss savings like these! Challenge us to deliver you better production whatever you turn—and prove it . . .
The Monarch Machine Tool Company, Sidney, Ohio

♦ While flat templates are generally employed with Keller controls, S. K. F. achieves the necessary high accuracy by so positioning master work pieces between centers that stylus follows sharp edge of gash in form tool master. Another savings.

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES
FOR A BETTER TURN FASTER ...TURN TO MONARCH

For more information fill in page number on Inquiry Card, on page 263

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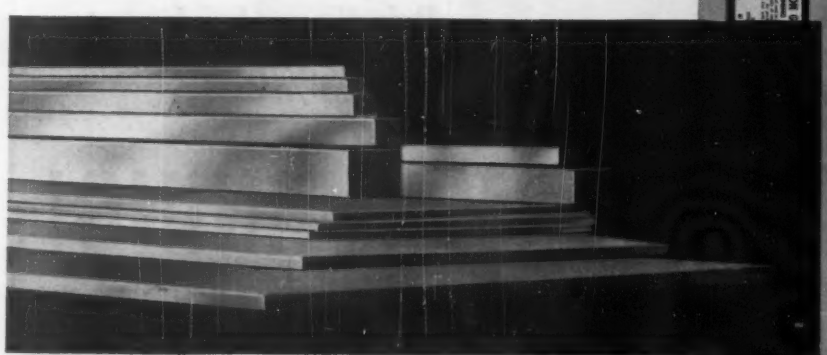

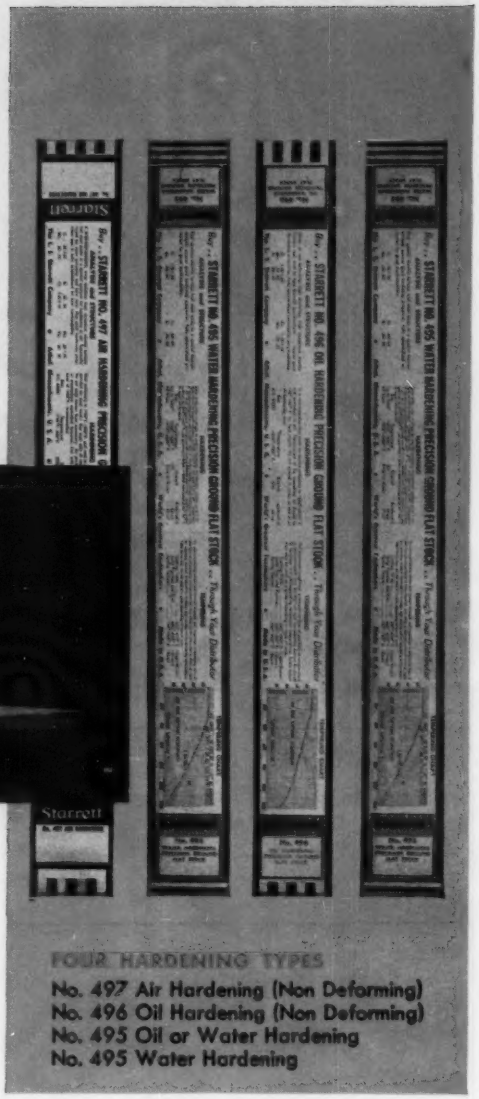
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HOW MANY WIRES CAN BE PACKED INTO A CIRCULAR CONDUIT?

By JACQUES DUTKA
Norden-Ketay Corporation and Columbia University

Editor's Introduction—*The number of circles that can be inscribed within an enclosing circle of a given diameter is of considerable importance in many engineering applications. One typical mechanical application involves determining how many circular rods or wires can be packed into a tube or conduit. If a graphical method is used in the solution of this problem, it will be, at best, tedious; empirical methods, or the use of tables based on empirical formulas, may be quicker, but are limited in accuracy.*

A rational mathematical approach has been developed by Dr. Dutka to the general solution of these three cases of greatest practical interest, namely, when the wires are packed around a central core of one wire, two wires, or three wires, as shown in the diagram.

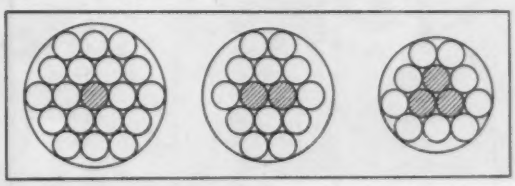
The data given in the table for each of the three cases cover a sufficient range for most purposes. However, for those interested in knowing how the data were computed and how data outside the range of the tables may be computed, Dr. Dutka's work is published herewith in its entirety.

Suppose a bundle of wires of uniform circular cross-sections is packed into a conduit of circular cross-section. Let the outside radius of a wire be unity and let the inside radius of the conduit be denoted by R, so that R is also numerically equal to the ratio of conduit diameter to wire diameter. It is the object of this article to furnish at least partial answers to several questions:

1. How many wires can be packed into a conduit of a given radius R if the wires form certain pre-assigned patterns?
2. What is the minimum size conduit required to contain a given number of wires if the wires form certain pre-assigned patterns?
3. What is the maximum number of wires which can be packed into a conduit of radius R if the pattern of the wires is unrestricted?

Case I: Single-Wire Central Core

In the diagram is shown a conduit consisting of a single-wire central core surrounded by layers of other wires in the densest possible packing. The centers of the wires form equilateral parallelograms of interior angles 60° and 120°. Geometrically, the problem of finding the number



Three possible arrangements of wires packed into a conduit around a central core. (Left) Single-wire core; (center) two-wire core; and (right) three-wire core

of wires in a conduit of radius R in this arrangement is equivalent to finding the number of vertices of parallelograms which lie in or on a circle of radius $R-1$ whose equation is $x^2+y^2=(R-1)^2$. The transformation $x=2u+v$, $y=\sqrt{3}\,v$ reduces the geometric problem to finding the number of lattice points (points whose coordinates are integers) in or on the ellipse $u^2+uv+v^2=(R-1)^2/4$.

It can be shown* that the number of representations in integers of a positive integer n by the quadratic form $Q\equiv u^2+uv+v^2$ is $6H(n)$, where $H(n)$ is defined as the excess of the number of divisors of n of the form $3m+1$ over the number of divisors of n of the form $3m+2$. Thus, if $N_1(R)$ denotes the number of wires within the circular conduit of radius R in the arrangement described above, then

$$N_1(R)=1+6\sum_n H(n)$$

where the sum on the right is taken over all integer values of n which satisfy the inequalities $1\le n\le(R-1)^2/4$. To put this result in a more tractable form, let $A=(R-1)^2/4$ and let $[x]$ be defined as the largest integer which does not exceed x. Now $[A/(3m+1)]$ is the number of integers which do not exceed A and which are divisible by $3m+1$, while $[A/(3m+2)]$ is the number of integers which do not exceed A and which are divisible by $3m+2$. Hence the above equation may be put in the form

$$N_1(R)=1+6\left\{\left[\frac{A}{1}\right]-\left[\frac{A}{2}\right]+\left[\frac{A}{4}\right]-\left[\frac{A}{5}\right]+\cdots+\left[\frac{A}{3m+1}\right]-\left[\frac{A}{3m+2}\right]+\cdots\right\} \quad (1)$$

where the series on the right is finite.

From this formula, for $R=5$ and $A=(5-1)^2/4=4$,

$$N_1(5)=1+6\left\{\left[\frac{4}{1}\right]-\left[\frac{4}{2}\right]+\left[\frac{4}{4}\right]\right\}=1+6\left\{4-2+1\right\}=19$$

which agrees with the total in the table for Case I when $R=5$.

* See Dickson, *Introduction to the Theory of Numbers*, Chicago, 1929

For large R, a direct evaluation of $N_1(R)$ is tedious and an asymptotic formula may be preferable. Such a formula may readily be obtained by a method due to K. F. Gauss. In the initial configuration described above, the area of the region covered by equilateral parallelograms whose lower left-hand corner is in or on the circle $x^2+y^2=(R-1)^2$ is $N_1(R)\cdot 2\sqrt{3}$. The area of the smallest circle centered at the origin which encloses this region is $\pi(R-1+2\sqrt{3})^2$ and the area of the largest circle centered at the origin which is included in this region is $\pi(R-1-2\sqrt{3})^2$. Hence it follows that

$$\pi(R-1-2\sqrt{3})^2<N_1(R)\cdot 2\sqrt{3}<\pi(R-1+2\sqrt{3})^2$$ and so for large R

$$N_1(R)\sim\frac{\pi}{2\sqrt{3}}(R-1)^2$$ so that $N_1(R)$ is approximately equal to

$$0.907\,(R-1)^2 \quad (2)$$

If the number of wires in a conduit is fixed and the configuration is as described above, then the size of conduit required to contain these wires can be found approximately by inverse interpolation in (2) and more exactly by inverse interpolation in (1) above.

Case II: Two-Wire Central Core

Another common arrangement in wire packing is the case where there is a central core in the conduit consisting of two contiguous wires, the core being surrounded by layers of other wires in the densest possible packing as shown in the diagram.

$N_2(R)$, the number of wires in a conduit of radius R in this arrangement is equal to the number of vertices of parallelograms which lie on or in the circle $(x-1)^2+y^2=(R-1)^2$. As in Case I, the transformation $x=2u+v$, $y=\sqrt{3}\,v$ is used. Then $N_2(R)$ is equal to the total number of solutions in integers of the equation $4u^2+4uv+4v^2-4u-2v+1=2m+1$, where m assumes all integral values satisfying the inequalities $1\le 2m+1\le(R-1)^2$. Let $2u=s+t+1$ and $v=-t$, then the last equation reduces to $s^2+3t^2=2m+1$ and it can be shown* that the number of representations of $2m+1$ by the quadratic form s^2+3t^2 is $2H(2m+1)$. Hence,

$$N_2(R)=2\sum_m H(2m+1)$$

where the sum on the right is taken over all integral values of m satisfying the inequalities $1\le 2m+1\le(R-1)^2$.

Now if l is a positive odd integer, then $H(2k\cdot l)=0$ or $H(l)$ according as k is odd or even. It follows that

$$N_2(R)=2\left\{\sum_{r=1}^{[4A]}H(r)-\sum_{r=1}^{[A]}H(r)\right\}$$

and then, as in Case I,

$$N_2(R)=2\left\{\left[\frac{4A}{1}\right]-\left[\frac{4A}{2}\right]+\cdots+\left[\frac{4A}{3k+1}\right]-\left[\frac{4A}{3k+2}\right]+\cdots\right\}-2\left\{\left[\frac{A}{1}\right]-\left[\frac{A}{2}\right]+\cdots+\left[\frac{A}{3k+1}\right]-\left[\frac{A}{3k+2}\right]+\cdots\right\} \quad (3)$$

where the series on the right are finite.

From this formula, for $R=5$ and $A=4$,

$$N_2(5)=2\left\{\left[\frac{16}{1}\right]-\left[\frac{16}{2}\right]+\left[\frac{16}{4}\right]-\left[\frac{16}{5}\right]+\left[\frac{16}{7}\right]-\left[\frac{16}{8}\right]+\left[\frac{16}{10}\right]-\left[\frac{16}{11}\right]+\left[\frac{16}{13}\right]-\left[\frac{16}{14}\right]+\left[\frac{16}{16}\right]\right\}-2\left\{\left[\frac{4}{1}\right]-\left[\frac{4}{2}\right]+\left[\frac{4}{4}\right]\right\}$$

$$=2\left\{16-8+4-3+2-2+1-1+1-1+1\right\}-2\left\{4-2+1\right\}=14$$

which agrees with the total in the table for Case II when $R=5$.

If the number of wires is fixed, then the size of conduit required in this configuration can be found by inverse interpolation in (3).

Case III: Three-Wire Central Core

The final case which will be considered is one in which three mutually contiguous wires form a central core in the conduit, the core being surrounded by layers of other wires in the densest possible packing, as shown in the diagram.

Let $N_3(R)$ denote the number of wires which can be packed into a circular conduit of radius R. $N_3(R)$ is equal to the number of vertices of parallelograms which lie in or on the circle $(x-1)^2 + (y-1/\sqrt{3})^2 = (R-1)^2$. Again using the transformation $x = 2u+v$, $y = \sqrt{3}\,v$, $N_3(R)$ is seen to be equivalent to the total number of solutions in integers of the equation $12u^2+12uv+12v^2-12u-12v+4 = 4(3m+1)$ where m takes on all integral values satisfying the inequalities $1 \leq 3m+1 \leq 3(R-1)^2/4$. Let $v = -t$ and $2u = (s+t+1)$ then the last equation reduces to $(3t+1)^2+3s^2 = 4(3m+1)$. Now it can be shown[†] that the number of representations of $4 \cdot (3m+1)$ by the quadratic form $\overline{\quad}^2 + 3\square^2$ is $6H\,4(3m+1)$ and, rejecting those representations in which $\overline{\quad} = 3t+2$, the number of solutions is $3H4(3m+1)$. Now $H4(3m+1) = H(3m+1)$, so that for $N_3(R)$,

$$N_3(R) = 3 \sum_m H\,(3m+1)$$

where the sum on the right is taken over all integral values of m satisfying the inequalities $1 \leq 3m+1 \leq 3(R-1)^2/4$. Now $H(3k+2) = 0$ where k is a non-negative integer and $H(3^k p) = H(p)$ where p is an integer which is not divisible by 3. It follows that

$$N_3(R) = 3\left\{\sum_{r=1}^{[3A]} H(r) - \sum_{r=1}^{[A]} H(r)\right\}$$

and then, as in Case I

$$N_3(R) = 3\left\{\left[\frac{3A}{1}\right] - \left[\frac{3A}{2}\right] + \ldots + \left[\frac{3A}{3k+1}\right] - \left[\frac{3A}{3k+2}\right] + \ldots\right\}$$
$$- 3\left\{\left[\frac{A}{1}\right] - \left[\frac{A}{2}\right] + \ldots + \left[\frac{A}{3k+1}\right] - \left[\frac{A}{3k+2}\right] + \ldots\right\} \quad (4)$$

where the series on the right are finite.

From this formula, for $R = 5$ and $A = 4$,

$$N_3(5) = 3\left\{\left[\frac{12}{1}\right] - \left[\frac{12}{2}\right] + \left[\frac{12}{4}\right] - \left[\frac{12}{5}\right] + \left[\frac{12}{7}\right] - \left[\frac{12}{8}\right] + \left[\frac{12}{10}\right] - \left[\frac{12}{11}\right]\right\} - 3\left\{\left[\frac{4}{1}\right] - \left[\frac{4}{2}\right] + \left[\frac{4}{4}\right]\right\}$$
$$= 3\{12-6+3-2+1-1+1-1\} - 3\{4-2+1\} = 12$$

which agrees with the total in the table for Case III when $R = 5$.

If the number of wires is fixed, then the size of conduit required in this configuration can be found by inverse interpolation in (4).

Densest Packing of Wires

The general problem of determining the densest possible packing for a given number of wires or for a given size conduit has not been solved — at least so far as is known to the writer. About all that is known in this direction is the following result†:

If $M(R)$ denotes the maximum number of wires which can be packed into a circular conduit of radius R, $R > 2$, then

$$\frac{\pi}{2\sqrt{3}}(R-1)^2 < M(R) < \frac{\pi}{2\sqrt{3}}R^2 \quad (5)$$

While this remark is not very useful, the table that follows may be more helpful in this regard. Here n denotes the number of layers surrounding the central core in the densest possible packing, while R denotes the radius of the conduit which circumscribes the configuration consisting of the central core plus n layers of wires, each wire having a radius of r.

For instance, if twelve wires are to be packed into a conduit, it is evident that a central core of three wires will yield a more efficient packing than any of the other cases, etc.

Conduit Radii R to Contain M(R) Wires in n Layers

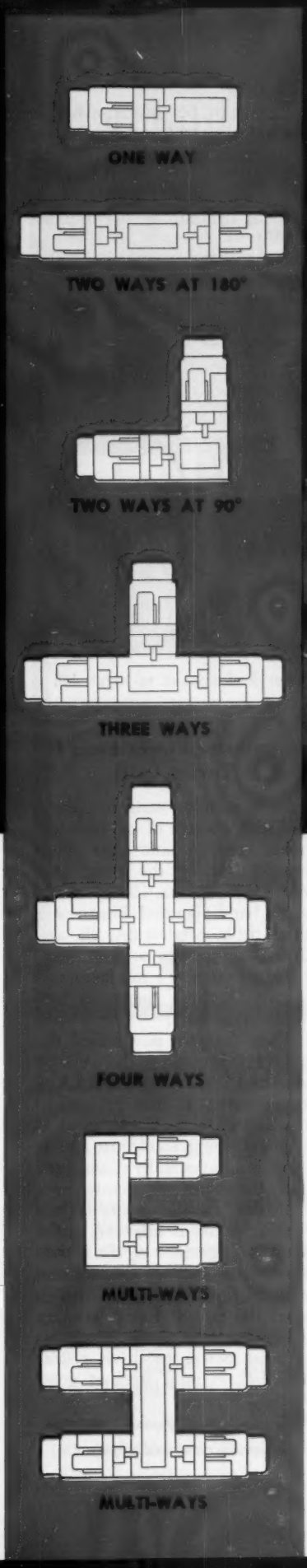
Central Core	Conduit Radius R	Number of Wires $M(R)$ in n Layers Plus Core
One wire	$R = (2n+1)\,r$	$M(R) = 3n^2+3n+1$
Two contiguous wires	$R = (2n+2)\,r$	$M(R) = 3n^2+5n+2$
Three wires forming an equilateral triangle	$R = (2n+1+2/\sqrt{3})\,r$	$M(R) = 3n^2+6n+3$
Four wires forming a square	$R = (2n+1+\sqrt{2})\,r$	$M(R) = 3n^2+7n+4$

† Fejes Tóth, *Lagerungen in der Ebene auf der Kugel und im Raum*, Berlin, 1953, pp. 67, 93.

Number of Circles Enclosed Within an Enclosing Circle for Central Core Consisting of One, Two, and Three Circles

$R = \frac{\text{Large Diameter}}{\text{Small Diameter}}$ (See footnote) Range of R		Number of Circles Enclosed Including Core
from	to (but not including)	
CASE I: ONE-CIRCLE CENTRAL CORE		
3	4.464	7
4.464	5	13
5	6.292	19
6.292	7	31
7	7.928	37
7.928	8.211	43
8.211	9	55
9	9.718	61
9.718	10.165	73
10.165	11	85
11	11.392	91
11.392	11.583	97
CASE II: TWO-CIRCLE CENTRAL CORE		
2	2.732	2
2.732	3.646	4
3.646	4	8
4	4.606	10
4.606	5.359	14
5.359	5.583	18
5.583	6	22
6	6.196	24
6.196	6.568	26
6.568	7.083	30
7.083	7.245	34
7.245	7.557	38
7.557	8	42
8	8.550	48
8.550	8.810	52
8.810	8.937	56
8.937	9.185	60
9.185	9.544	64
9.544	9.660	68
9.660	9.888	70
9.888	10	74
10	10.539	76
CASE III: THREE-CIRCLE CENTRAL CORE		
2.155	3.309	3
3.309	4.055	6
4.055	5.163	12
5.163	5.619	18
5.619	6.033	21
6.033	6.773	27
6.773	7.110	30
7.110	7.429	36
7.429	8.024	42
8.024	8.572	48
8.572	9.083	54
9.083	9.326	63
9.326	10.018	69
10.018	10.238	75

Ratio R of enclosing circle diameter to diameter of enclosed circles.



Ex-Cell-O 4-Way Machine precision bores four holes simultaneously, holding 90° angles.

7 ways to increase your production

Three new features on all Ex-Cell-O Way Machines give even greater production and precision

The diagrams at left tell a story.

Ex-Cell-O Way Machines using standard components in the combinations illustrated perform precision boring, turning, facing, grooving and chamfering operations economically and quickly. They take large work pieces in stride—the spindles move to the work.

In each machine three new features assure long life, dependable operation, and exceptional accuracy.

The features: (1) ways are hardened and ground, (2) slides are fully supported the length of the stroke, (3) hydraulic control panels give a wide range of automatic cycles.

Write Ex-Cell-O in Detroit for further information. Better still, call in an Ex-Cell-O representative.

EX-CELL-O CORPORATION

EX-CELL-O FOR PRECISION

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56-44

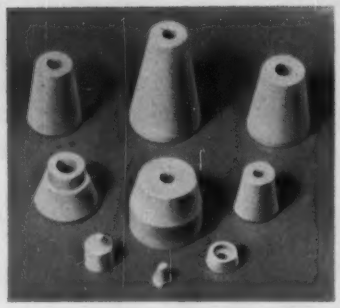
Whitman & Barnes Carbide Die Drills and Short-Length Power Drills

Whitman & Barnes, Plymouth, Mich., have announced a complete line of carbide die drills specifically designed for drilling hardened die steel. According to the manufacturer, these drills, see Fig. 1, permit hardened parts to be economically salvaged without annealing, reworking, or rehardening. They can be used for cutting through hard outer cases and for drilling intricate parts that have been hardened. These drills are available in sizes from 1/16 to 3/4 inch.

Whitman & Barnes have also brought out a series of short-length power drills like the one shown in Fig. 2. These drills are available in fractional and wire gage sizes and have the same specifications as screw machine drills except for their specially designed, heavier webs which make them particularly suitable for use in portable machines.

These short-length power drills are said to withstand considerable strain and will drill successfully where full-length drills may fail. They are recommended for drilling operations on truck and auto bodies, and for drilling sheet metal and stainless steel.

Circle Item 148 on postcard, page 263



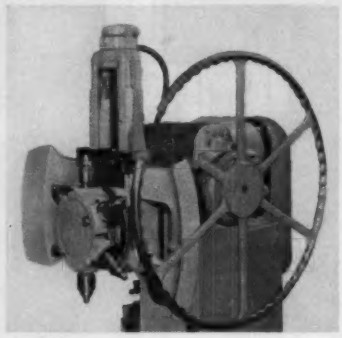
Ceramic shapes used for deburring operations, announced by American Lava Corporation

Ceramic Material for Deburring and Burnishing

A deburring agent for machined or stamped metal parts and sheet metals such as aluminum has been discovered in AlSiMag 491 ceramic announced by American Lava Corporation, Chattanooga, Tenn. Faster, cleaner operation is said to be possible when this material is used since it does not load up with metal, and high speeds do not produce adverse effects. Exceptionally long tool life has also been experienced when this ceramic material is used for deburring operations. The material also has a remarkable ability for producing a keen edge on precision tools—even those made of carbides.

Parts can be custom-made in desired shapes for deburring or sharpening in diameters ranging from 1/2 inch to 3 inches. AlSiMag 491 is a fine-textured, vitreous ceramic of the alumina type. It is extremely hard (measuring more than 9 on Mohs' scale), and its strength and durability make it particularly suited for a wide range of applications.

Circle Item 149 on postcard, page 263



Power feed applied to turret drill

Burgmaster Power Feed for Turret Drill

An infinitely variable power feed with a range of 1/2 inch to 6 inches per minute has been brought out by the Burg Tool Mfg. Co., Gardena, Calif., for use on its hand-operated Burgmaster turret drills, Models 2A, 2B, and 2BR. This feed can be installed at the plant on new equipment or—in two to three hours—on machines in the field.

When using the power feed, the tool is first brought to the work by operating the feed-wheel. The starter button is then pressed to engage the feed. Engagement is effected through an electric clutch, which is automatically disengaged when the depth stop-screw for a particular spindle contacts the stop-bar. Feed is adjusted either before engagement of the clutch or while the cutting tool is in the work by turning a knob which varies the rate of feed according to a graduated scale. The unit has sufficient power to drive a 3/4-inch drill in mild steel at good production rates.

Circle Item 150 on postcard, page 263

(*This section continued on page 250*)

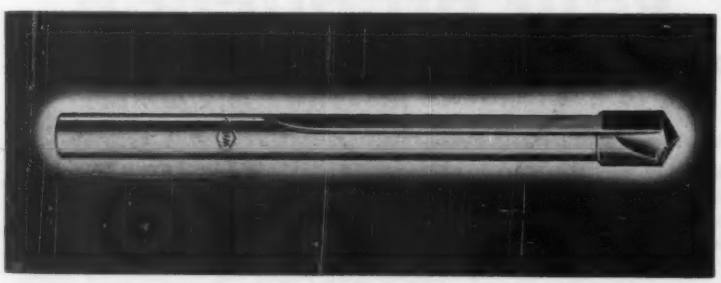


Fig. 1. Whitman & Barnes carbide die drill

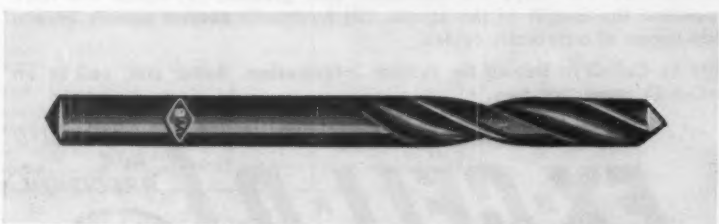


Fig. 2. Short-length power drill made by Whitman & Barnes

Matching metal to job with Bridgeport alloys

These intricate bamboo-design table legs are machined from Bridgeport Alloy #6 Free-cutting Brass Rod.
Table rim is formed into circle, then soldered. For this part, Bridgeport supplies Yellow Brass strip in a soft temper for bending.
Tables made by I. W. Arm Works, New York, for Jeral Brass Products, New York, N.Y.

For machined parts with a furniture finish...
Bridgeport HIGH I. Q.* rod

When finish is a factor – as in these unusual machining jobs – it's important that you choose the alloy with exactly the *right* combination of physical properties. Bridgeport's wide range of quality alloys and technical experience in practical production problems make it easy to match the right metal to your product or design. For brass, copper or aluminum, call or write your Bridgeport Sales Office today. They'll also be glad to arrange for Bridgeport Technical Service on your metals and methods.

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Bryant Face Squareness and Concentricity Gage

Combination face squareness and concentricity gage manufactured by the Bryant Gage & Spindle Division, Bryant Chucking Grinder Co., Springfield, Vt., shown in use checking aircraft cylinder hold-down bolts. Three simultaneous checks are made. These are: checking size of three 7/16–20 NF threads; checking concentricity of 0.435- to 0.434-inch diameter in relation to thread; and checking under face squareness of bolt-head bearing surface in relation to thread. A ball slide follower attachment used with the gage compensates for thread progression as the work is turned.

Circle Item 151 on postcard, page 263

Schrader Plastic Blow Gun

Plastic blow gun No. 560, brought out by A. Schrader's Son, Division of Scovill Mfg. Co., Inc., Brooklyn, N. Y., for use in arsenals, chemical plants, and manufacturing departments where electrical disturbance or scratching is a safety problem. The light weight of the plastic gun is also a fatigue-reducing factor where repetitive operations tend to tire operators. Other features are simplicity and durability of parts, free flow of air, functional design with comfortable grip, and positive control over direction of air blast. Parts are quickly replaceable and interchangeable. Available in 1/4-inch thread size.

Circle Item 153 on postcard, page 263

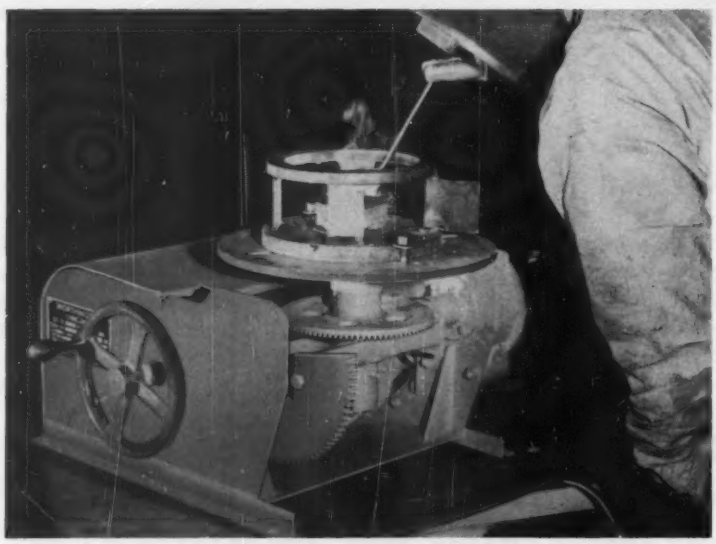
Wheelco Non-Indicating Potentiometer Type Controller

Wheelco 150 series non-indicating controller of the potentiometer type offered by the Barber-Colman Co., Rockford, Ill., for control applications encountered in batch process work. This controller employs a circuit in which the unknown voltage is connected in opposition to a known voltage with any difference used to actuate the control circuit. When the voltage output of the sensing element reaches a value giving null balance, no current flows to the reactor, and the thyratron is "cut off." In this manner, the circuit to the control relay is de-energized. The Model 151 "Amplitrol," not shown, is a simple on-off controller for those applications where transfer lag and dead time can be reduced to a negligible value and the simplest of control forms made usable. The Model 152 is an "anticipatory" time-proportioning controller which compensates for system inertia. A time-constant network within this controller causes a control device to go to the "off" position slightly before

Worthington Power-Operated Welding Positioner

Power-operated bench Model 1P welding positioner brought out by the Worthington Corporation, Plainfield, N. J. This positioner is especially adapted for positioning small work in shops and educational or industrial laboratories. Variable-speed drive table rotation and accurate worm-and-segment hand tilting facilitate welding, hard surfacing, assembling, repairing, grinding, and similar operations by positioning work to the best advantage for the operator. Disengaging the clutch provides free wheeling whenever desired.

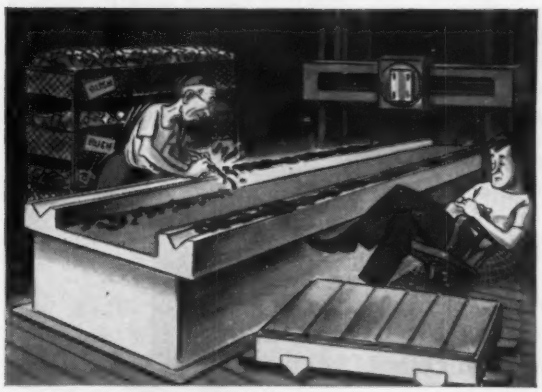
Circle Item 152 on postcard, page 263



1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.

2. Doesn't squeeze out. When you use a heavy oil as a way lubricant, you must use a lot of oil to maintain a thick enough film. But, heavy oil squeezes out if the table sits in one position very long. You have a tough time getting the table moving again. Protected by the tenacious thin film formed by Sunoco Way Lubricant, the machine can be idle for a week and it will start easily.

WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



3. Protects expensive ways. Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.

For the lubrication of slides and ways on this machine, we recommend the use of
SUNOCO WAY LUBRICANT
a product of
SUN OIL COMPANY

4. Approved by more than 55 machine-tool builders. Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-10.

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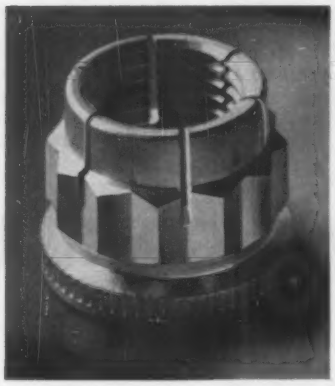
the normal "off" point is reached; likewise, the "on" cycle starts slightly ahead of the normal controller "on" point. The contact rating of the new Wheelco 150 Series Amplitrol is 6 amperes at 115 volts alternating current and 3 amperes at 230 volts alternating current. Sensitivity of the instrument is 75 microvolts for all scale spans. The fixed cycle time of the Model 152 is approximately 18 seconds.

Circle Item 154 on postcard, page 263



Lock-Nut for Jet Engines

"Flexloc" self-locking lock-nut for use at elevated temperatures up to 1200 degrees F. introduced by Standard Pressed Steel Co, Jenkintown, Pa. This lock-nut, designated 119FW, is intended primarily for aircraft use. It has the high temperature and corrosion resistance necessary to maintain tensile strength and resist galling and seizing after sustained exposure to high temperatures. This one-piece, all-metal lock-nut has a 12-point external wrench section and can be used in jet-engine manifolds, afterburners, and similar high-temperature applications. The slotted locking collar of the lock-nut is squeezed in slightly during manufacture. As the nut is threaded onto a bolt, the collar segments expand. Spring tension of the segments holds the nut securely in place even under severe vibration. Available in standard sizes from No. 10 through 1/2 inch in diameter. It is made of AMS 5735 stainless steel and is silver-plated.

Circle Item 155 on postcard, page 263

Kendex Turning, Profiling and Chamfering Tool

Kendex tool Style KSDN, designed for turning, profiling, and chamfering in either direction, announced by Kennametal Inc., Latrobe, Pa. This tool has the same general shape as a style "D"

brazed-tip tool and is available with either a 7-degree positive or a 5-degree negative back rake. Both types feature square throw-away indexable inserts. A choice of two styles of inserts is available for both the positive and the negative rake tool-holders. They are: 1. Utility—ground top and bottom. 2. Precision—all surfaces ground. Precision inserts can be indexed to within plus or minus 0.001 inch. Kennametal seats are furnished with all tools. Chip-breakers that are said to provide a wider effective range of applications than any mechanical chip-breaker previously developed are also available.

Circle Item 156 on postcard, page 263

Universal Type Load Cells

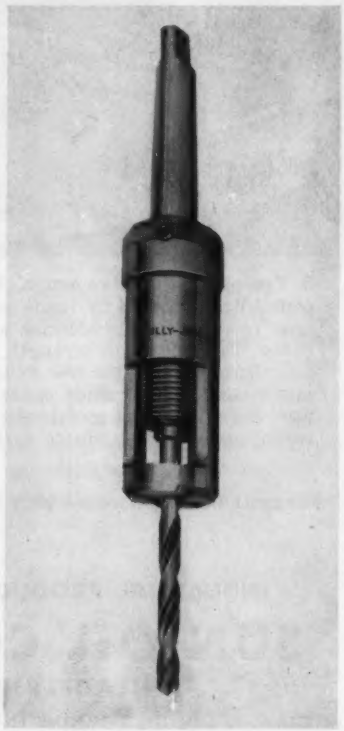
Baldwin SR-4 universal type load cells available in 50-, 100- and 200-pound capacities which have been announced by Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Reduced substantially in size and designed with linearity (within plus or minus 0.10 per cent), they have been improved over previous models. The new U-1-B cells—in which the principle of the bonded resistance wire strain gage is utilized—are now 3 1/4 inches in height and 3 1/2 inches in diameter, permitting more compact SR-4 electronic weighing and control systems. The former height of SR-4 cells for

measuring tension and compression loads was 5 3/4 inches and the diameter 4 inches.

Circle Item 157 on postcard, page 263

Scully-Jones Improved Drill Stop

Drill stop of improved design for positive control of depth of hole brought out by Scully-Jones & Co., Chicago, Ill. This stop is made for precise depth control of operations such as drilling and reaming on turret lathes, radial drills, and other drilling machines. It will stop against a fixture bushing or the face of the work with dependable accuracy. Micrometer adjustment is obtained by the



Welsbach High Pressure Service Gas Valve with Revere Arsenical Bronze Stem.

REVERE

Deep-Drilling Brass Rod

Increases Tool Life over 200% for Welsbach Why not try it yourself?

In the manufacture of valves the Kitson Division of The Welsbach Corporation, Philadelphia, Pa., has to deep-drill brass rod. Originally the rod was free-machining brass. However, when Revere discovered the extent of the drilling it was suggested that our Mixture 252, Deep-Drilling Brass, would be preferable. This was tried, and the machine shop foreman reported that tool life was increased over 200%. In one item it is possible to bore with a single operation, against the former practice of withdrawing the drill three times in order to clear the chips. Revere's Deep-Drilling brass produces very small, easily cleared chips.

Another item is a high pressure gas valve, with a cast body and brass rod stem. The rod was changed to arsenical bronze, which costs a bit more, but it ended flaking and galling between stem and seat, and materially reduced rejects. Still another instance of Revere service concerns a hot water heater relief valve. The original model was cut out of bar stock. We suggested a high leaded brass tube, hexagon outside, round inside. This greatly reduces machining, has a better surface, and a better seat. Costs more by the pound, but saves more by the piece.

Revere salesmen and Technical Advisors are always glad to collaborate in seeking ways to save money and improve products. Perhaps we can help you!

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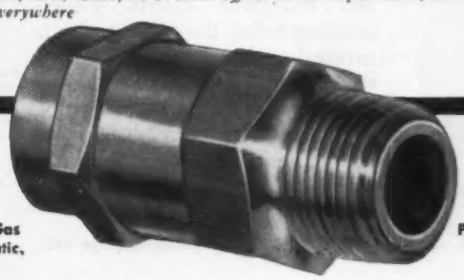


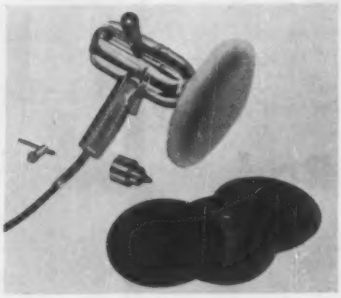
Welsbach Temperature-Pressure Relief Valve.

Welsbach Emergency Gas Shut-Off Valve, automatic.

Pressure Relief Valve for water heaters.

combination of a new precision-calibrated, quick-lock nut and a reference line on the threaded body of the tool. Standard drill stops are available in eight sizes to accommodate drills up to 1 1/2 inches in diameter.

Circle Item 158 on postcard, page 263



Thor "SpeedPolisher"

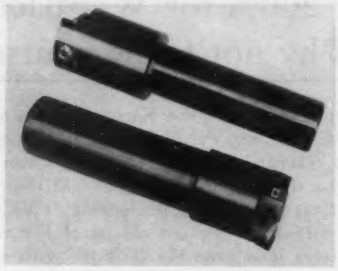
"SpeedPolisher" equipped for both polishing and sanding announced by the Thor Power Tool Co., Aurora, Ill. This tool weighs only 4 1/2 pounds equipped with a large offset handle and a removable side handle. It is suited for wood sanding and polishing, and for fast application of standard cleaners in polishing operations. The tool is supplied complete with all necessary accessories for polishing and sanding, as well as a 3/8-inch geared chuck for drilling. A wide assortment of basic accessories is available.

Circle Item 159 on postcard, page 263

Ross Sequence Valves for Controlling Air Circuits

Sequencing type valves for controlling air circuits introduced by Ross Operating Valve Co., Detroit, Mich. The TD and WV sequence valves provide for a preset pattern of operations to be automatically carried out by a machine after the operator initiates the cycle. Cylinders can be sequenced by position or time and their action interlocked in the circuit. Three types of valve heads control these valves. MV remote-control valves have immediate actuation and immediate reversal. The TD sequence valves have delayed actuation and immediate reversal, while the WV sequence valves have immediate actuation and delayed reversal. Available models include straight-way and three-way, normally opened and normally closed valves. They are provided for in-line mounting in 1/4-inch to 1 1/4-inch sizes.

Circle Item 160 on postcard, page 263



Micro-Adjustable Boring Tools

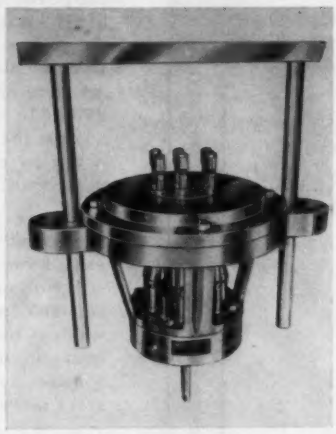
Micro-adjustable boring tools of line employing indexable carbide tips which are thrown away when all cutting edges (up to 8 per tip) are dull. These tools, introduced by the Wesson Co., Ferndale, Mich., are fitted with a vernier-screw adjustment for controlling the diameter of cut. The circular dial has twenty graduations, each representing a total of 0.001 inch adjustment. A built-in chip-breaker is provided which also serves as a clamp for the boring tip. Serrations on the clamp provide adjustment for positive chip control. This line of boring tools permits the use (with changes of only minor parts) of round, square, and triangular inserts. Relief-grinding below the cutting edge is avoided in these tools by locating the cutting edge of the tip slightly above center. This type of tool, using a special anvil-locator, is adaptable to internal (American screw) threading operations, using 60-degree triangular inserts.

Circle Item 161 on postcard, page 263

Williams Midget Wrench

"Midget Superrench" of unusually thin and slim design brought out by J. H. Williams & Co., Buffalo, N. Y., to extend the range of opening sizes of their 15-degree-75-degree line to include 9/16- and 5/8-inch sizes. The line now carries thirteen sizes with openings from 3/16 to 5/8 inch. Both heads have the same opening size. These wrenches are especially adapted for making delicate adjustments in close quarters. They are drop-forged from selected alloy steel, heat-treated, and chrome-plated over nickel.

Circle Item 162 on postcard, page 263



Spindle Locator Plate for Drilling and Tapping Heads

Spindle locator plate designed to convert fully adjustable universal joint drilling and tapping heads made by Errington Mechanical Laboratory, Inc., Staten Island, N. Y., to controlled jig-bored, fixed-center heads. The locator plate can be adapted to the 1/4-, 1/2- and 29/32-inch capacity heads. The plates are made of sand-cast aluminum, turned all over, jig-bored to specific job requirements, and fitted with bushings. They are interchangeable with the standard locator arms of Errington universal joint heads.

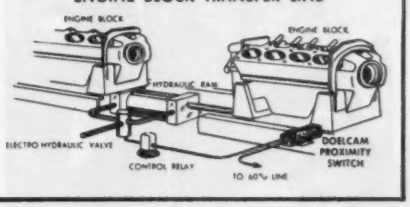
Circle Item 163 on postcard, page 263

Announcing... the Modern Successor to the Mechanical Limit Switch

MODEL T-271
Shown ¾ size

- **NO MOVING PARTS**
  Has no electrical contacts or moving parts
- **WEAROUT PROOF**
  Uses no vacuum tubes or other components of limited life
- **NO MECHANICAL LINKAGES**
  Requires no physical contact with workpiece
- **FAST RESPONSE**
  Will operate up to 10 times per second
- **POWER REQUIREMENTS**
  Conventional 115 volts 60 cycle source

TYPICAL APPLICATION
PROXIMITY SWITCH ACTUATING ENGINE BLOCK TRANSFER LINE



Doelcam PROXIMITY SWITCH

MECHANICAL AND ELECTRICAL FAILURES ELIMINATED

The Doelcam Proximity Switch detects the presence of ferrous objects without requiring physical contact. It's a newly developed magnetic device containing no moving parts. Detection is accomplished as the object passes through a magnetic field set up directly in front of the switch's sensing head. The switch transmits an electrical signal which operates a control relay that may be remotely located. Many industrial automation processes are replacing the conventional limit switch with the newly developed Doelcam Proximity Switch to avoid work stoppages due to mechanical failure. Among some of these applications are switching operations in materials handling control and automatic machine tools.

Write for Bulletin PS-44

Doelcam
A DIVISION OF MINNEAPOLIS-HONEYWELL

1400 SOLDIERS FIELD ROAD
BOSTON 35, MASSACHUSETTS

Instruments for Measurement and Control

Synchros • Gyros • Accelerometers • Amplifiers • Microsyns • Servo Motors

Between Grinds

To Bone on Ozone

The first international conference on ozone—the fuel that may power man's first rocket to the moon—will be held in Chicago November 28 to 30 under the sponsorship of the Armour Research Foundation of Illinois Institute of Technology. Scientists are anxious to learn how they can make ozone, an extremely unstable chemical, behave. Remember when people used to bandy the word "ozone" around? "Let's take a drive and get some ozone." Wouldn't dare do it now; might find themselves headed for outer space.

Tool Lore

The world's first tool engineer was Tubalcain, an eighth generation descendant of Adam, according to a booklet entitled "The First Tool Engineer" (published by the American Society of Tool Engineers), which quotes references from the Old Testament to support its contention. Tubalcain first concentrated on weapons for hunting and developed the methods completely from forging to finish-grinding. When the critical shortage of weapons had been changed to a surplus, production was converted to peacetime products such as brass bowls, the booklet tells us. But then came the great flood. Our surmise is that his name was originally "Tube and Chain."

Now Wise About Size

The Library of the Office of Defense Mobilization wrote, asking for a reprint of the "article on Elephant Pools" which appeared in April MACHINERY. The girl whose desk the letter crossed, unfamiliar with government nomenclature, reacted normally—quipped about Barnum & Bailey bathtubs, who teaches elephants to swim, walruses?, or do they elephant paddle, are they learning water ballet, and so on. But she got around to sending the requested article, "Building the Big Ones."

The Man in the Aluminum-Coated Suit

An engineer wearing an aluminum-coated suit walked into a 1200-degree F. oven carrying a steak and waited a minute and a half until it cooked to medium rare—while he didn't. This feat was one of several performed at a recent demonstration to show how the Minnesota Mining & Mfg. Co. has developed fabrics with heat-protective qualities so that repair or rescue missions can be carried on at high temperatures. The man who donned the suit was D. J. Bennett. He has tested it about 200 times and says "The only heat I feel is the accumulation of my own body heat." When things get hot at home, DJB knows just what to do.

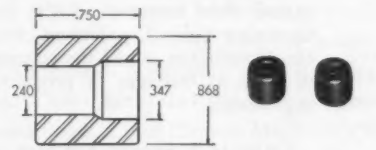
ELI'S GUN LANDS IN LONDON—Louis Polk, (striped tie), president of the Sheffield Corporation, presents an Eli Whitney musket from his personal collection to Sir James Mann (striped trousers), Master of the Armouries in the Tower of London, for the collection started by Henry VIII in the Sixteenth Century. The historic Yankee weapon, developed by Eli Whitney in 1799 and manufactured through 1812, is considered the "first product which demonstrated to American and world industry that it was possible to manufacture standardized articles on a mass basis, with interchangeable parts." In his capacity as president of the National Machine Tool Builders' Association, Mr. Polk was recently in England to address industrial meetings.

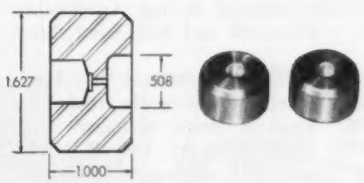
Finish turning operation on a hi-speed steel heading die, using a Monarch 13″ Series 61 Air-Gage Tracer Lathe, .015″ stock is removed within a limit of ±.0005″. Turning time is 15 minutes compared to 2 hours previously required on a conventional engine lathe.

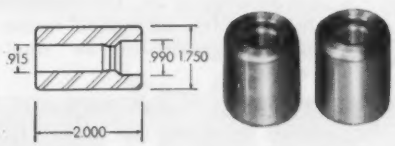
WITHOUT MONARCH–TIME'S A-WASTING!

Air-Gage Tracer Lathes Cut Contouring Time from 2 Hours to 15 Minutes — ± .0005″!

Group of typical heading dies which are finish bored on the 10″ Model EE Air-Gage Tracer machines. Drawings show complexity of work. Under the same conditions as above, the same time savings are realized.







Can you ignore savings like these reported by Standard Pressed Steel Company?

They use a battery of Monarch Air-Gage Tracer lathes in their production toolroom for finishing operations on small forging dies. Most of the work is contour boring to exceptionally close limits plus quite a variety of contour turning.

The machines go sixteen hours per day, six days per week. Monarchs were chosen because of Standard Pressed Steel's previous satisfaction with this make of lathe. The Monarch flame hardened, precision ground bed ways are considered a must in this plant. These tracer controlled lathes are much faster and more accurate than the conventional engine lathes previously used and more uniform in performance.

Now, check over the job reports in the picture captions. Two hours cut to fifteen minutes! You're right —you can't ignore savings like these! Write now for our Booklet # 2608... **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A BETTER TURN FASTER ... TURN TO MONARCH

For more information fill in page number on Inquiry Card, on page 267

News OF THE INDUSTRY

California and Texas

VANADIUM-ALLOYS STEEL Co., Latrobe, Pa., has established a new West Coast firm to distribute warehouse stocks of high-speed and tool steels. The new firm, Vanadium-Pacific Steel Co., will be located in

R. P. Stemmler, newly appointed president of Vanadium-Pacific

the Los Angeles district at Maywood, Calif. R. P. STEMMLER has been elected president of Vanadium-Pacific. Mr. Stemmler was formerly associated with U. S. Steel and Allegheny Ludlum Steel Corporation.

NICHOLAS M. ESPOSITO has been appointed to the newly created post of production manager of H. W. Loud Machine Works, Inc., Pomona, Calif. Mr. Esposito was formerly with the Axelson Manufacturing Co., a Division of U. S. Industries, Inc. Prior to leaving Axelson, Mr. Esposito was production manager for the company's aircraft division.

RUSSELL E. BRYANT has been appointed by Wagner Electric Corporation, St. Louis, Mo. to manage the electrical division of its Los Angeles, Calif., branch. He succeeds LEONARD G. TANDBERG.

JOHN W. MECOM was elected a director of the Reed Roller Bit Co., Houston, Tex.

Illinois and Indiana

B. I. ULINSKI has been appointed director of development and design at the Automatic Transportation Co., Chicago, Ill. At the same time, it was announced that RAYMOND E. ORTON has been appointed manager of the company's product engineering department.

JOSEPH D. GAVIN has been appointed manager of the sheet and strip order department at the Joseph T. Ryerson & Son, Inc. steel service plant in Chicago, Ill. As assistant to ROBERT T. STAFFORD, manager of sheet and strip sales, he will assume administrative duties.

THEODORE BOLTON has been appointed Cleveland manager of the Chicago Wheel & Mfg. Co., Chicago, Ill. In his new post, Mr. Bolton will be responsible for the merchandising and distribution of the complete line of the company's products.

HOLCROFT & Co., Detroit, Mich., announce that the office of their Chicago representative, A. A. ENGELHARDT, will be located at 4935 W. Fullerton Ave., Chicago, Ill.

R. D. JONES has been appointed general sales manager of the Automatic Transportation Co., a division of Yale & Towne Mfg. Co., Chicago, Ill.

HUGH D. CONNELL has been manager of the project engineering department, Acme Steel Co., Chicago, Ill.

JAMES E. GOOD has been appointed as field sales manager of the Atkins Saw Division, Borg-Warner Corporation, Indianapolis, Ind.

Michigan and Wisconsin

VICKERS INCORPORATED, Detroit, Mich., announces the following appointments. GERHARD REETHOF has been named chief of research under Duncan Gardiner. Prior to joining the company, Dr. Reethof was an assistant professor of mechanical engineering at M.I.T. with research duties at the Dynamic Analysis and Control Laboratory. LEROY D. TAYLOR has been named assistant chief engineer for development. His responsibilities include supervision of advance development of all types of hydraulic units.

MUELLER BRASS Co., Port Huron, Mich., announces the following appointments: RICHARD C. HAENKE—sales representative Detroit, Mich.; MILTON W. GEKAS—sales representative Chicago, Ill.; GEORGE I. DUDDY—district manager New Orleans, La.; E. L. TREPPA—district manager Cambridge, Mass.; and VINCENT A. BOWER—district manager Dallas, Tex.

SUPERIOR BRASS WORKS, INC., Detroit, Mich., has purchased all of the machinery, equipment, and inventory of KENDRICK MFG. CO., also of Detroit. Superior will continue the manufacturing operations of that company as Kendrick Division.

FORMSPRAG Co., Van Dyke, Mich., has appointed the CHAS. A. STRELINGER Co., Detroit, as distributor of its industrial products for the southeastern area of Michigan.

ANDREW B. HUNTINGTON has been named chief engineer of the Ross Operating Valve Co., Detroit, Mich. Mr. Huntington joined the company in 1952 as manager of production engineering.

CHARLES J. STOFKO has been appointed general manager of the Barnes-Gibson-Raymond Divisions of Associated Spring Corporation at Plymouth and Ann Arbor, Mich.

R. T. JOHNSTONE has been appointed to the newly created post of assistant sales manager for The Cross Company, Detroit, Mich.

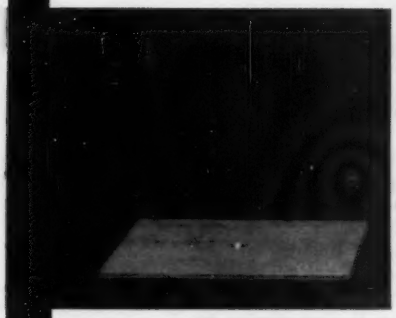
RACINE HYDRAULICS & MACHINERY, INC., Racine, Wis., announces the purchase of a new plant, known as Plant No. 2, of 25,000-square-foot area for the manufacture of its line of railroad-maintenance and power-hacksaw equipment.

ROBERT C. TESSMER has been appointed sales engineer of the Hydraulic Division, Racine Hydraulics & Machinery, Inc., Racine, Wis.

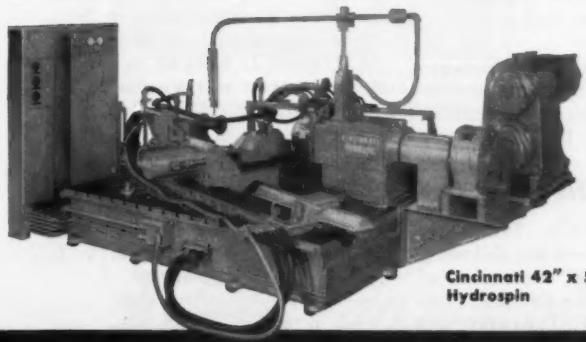
(This section continued on page 260)

Why remove metal when you can move metal

into the shapes you want with the Cincinnati Hydrospin



A wide range of parts can be produced quickly and at low cost by "*chipless machining*" on the Cincinnati Hydrospin. Less metal is wasted and parts have accurate dimensions, high strength and good finish. Let a Process Machinery Division field engineer give you full details. For a description of the process and machine specifications, write for Bulletin M-1873-3.



Cincinnati 42" x 50" Hydrospin

✳ Upper sequence of photos shows *one continuous* tube spinning operation. Starting blank, far left, of SAE 4130 is 8¾" long x 3" I.D. x 0.155" wall thickness. Finished part, shown at far right, Hydrospun in one pass, is 31" long x 3" I.D. with 0.030" wall thickness.

✳✳ Lower sequence of photos shows *one continuous* shear spinning operation. Starting blank, far left, is of type 302 stainless steel, 12" square x ¼" thick. Finished part, shown at far right, Hydrospun to a 32° included angle in one pass, is 14" high with 0.069" wall thickness.

CINCINNATI **Hydrospin**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

New England

R. S. WILDER, INC., Waltham, Mass., announces the appointment of OPTO-METRIC TOOLS, INC., 137 Varick St., New York City as their national and foreign distributor for their line of precision inspection equipment. They have also acquired part ownership in the new distributing organization.

RIVETT LATHE & GRINDER, INC., Boston, Mass., has appointed Overgard Machine Tool Co., Inc., 2045 W. Eighth Ave., Denver, Colo. as exclusive distributors in the Colorado-New Mexico territory for Rivett machine tools.

AMERICAN OPTICAL CO., Southbridge, Mass. announces the acquisition of the J. W. Fecker Inc., Pittsburgh, Pa. The company will be operated as a wholly owned subsidiary.

PAUL S. WASHBURN has been appointed a field engineer assigned to the Pittsburgh district office of the Norton Co., Worcester, Mass.

CLAUDE E. WEEKLY was appointed to the newly created post of product service engineer of Mac Dermid, Inc., Waterbury, Conn.

PRATT & WHITNEY CO., INC., West Hartford, Conn., announces the appointments of EDWARD J. SHAGES as vice-president and manager, and EARL R. LEWIS, JR. as production manager of the cutting tool and gage divisions. JAMES B. WILKIE was named manager of the gage division.

Edward J. Shages, vice-president and manager cutting tool and gage division, Pratt & Whitney

Edward S. Coe, Jr., vice-president of Farrel-Birmingham and manager Consolidated Machine Tool Division

EDWARD S. COE, JR., vice-president of Farrel-Birmingham Co., Inc., and recently elected to the board of directors, has been appointed general manager of the company's Consolidated Machine Tool Division, Rochester, N. Y. He succeeds LESTER D. CHIRGWIN, who formerly headed this division. Mr. Coe was previously assistant to the president at company headquarters, Ansonia, Conn., and also was manager of Farrel-Birmingham's Connecticut plants at Ansonia and Derby. In this latter capacity he has been succeeded by GRAHAM HASSARD who, since 1943, was superintendent of the company's two foundries.

JONES & LAMSON MACHINE CO., Springfield, Vt., has acquired the entire stock, trade names, design, and business of the Modern Tool Works, Rochester, N.Y.

F. E. PRINGLE has been appointed assistant general sales manager for the Howe Scale Co., Rutland, Vt.

CARLTON E. DENNIS has been appointed midwestern sales representative of the Welsh Manufacturing Co., Providence, R. I.

New York and New Jersey

H. K. PORTER CO., INC., New York City, announces the following changes in its sales department of the Alloy Metal Wire Division, Prospect Park, Pa.: W. J. LUSTER was appointed district sales manager of the New Jersey territory; E. F. HIRSCH was appointed district manager of the recently organized New York City area; W. E. SWEENEY, who is district sales manager of the Riverside Metal Division, will also handle the sales of alloy metal wire products in New York State and northern Pennsylvania. JOHN L. HOFFMAN has recently joined the sales department of Alloy Metal Wire Division.

BALDWIN-LIMA-HAMILTON CORPORATION announces that its New York District Sales Office will be moved to 111 Fifth Ave., New York City. At the same time it was announced that the Corporation opened a $3,000,000 plant at Waltham, Mass. to house its entire Electronics and Instrumentation Division under one roof. The component operations of this division will manufacture testing instruments, SR-4 strain gages and testing systems, testing machines, and allied equipment.

VANADIUM CORPORATION OF AMERICA has transferred its engineering department from the operating plant at Niagara Falls, N. Y., to new facilities at Cambridge, Ohio. Assistant vice-president H. C. PARKMAN will, in addition to his present duties, be in charge of engineering. Other new appointments include: R. A. DAVIDSON, chief plant engineer; FLOYD G. FELLOWS, power engineer; JAMES R. LEE, design engineer; and DELMON H. TAMMEN, chief field engineer.

MASON M. RANDLE has been appointed quality control manager for the Western Brass Mills Division, Olin Mathieson Chemical Corporation, New York City. Mr. Randle succeeds HERBERT A. BALL who has been transferred to New Haven, Conn., to become special test superintendent of the recently created Nuclear Fuel Division. Mr. Randle joined the Olin organization in 1934. At the same time the appointment of DR. EDWARD L. KOZICKY as director of conservation was announced.

SENECA FALLS MACHINE CO., Seneca Falls, N. Y., announces the following appointments: R. M. WHEELER has been made executive assistant; T. E. RODGERS was appointed works manager; and V. L. PERCY, chief engineer.

JAY B. SRYBNIK was elected vice-president of the S & S Machinery Co., Brooklyn, N. Y. Mr. Srybnik has been with the company since

(This section continued on page 268)

YOU'LL FIND G.S. GEARING IN TOP QUALITY PRODUCTS LIKE THESE . . .

Adding Machines • Aircraft Instruments and Radios • Automatic Musical Instruments • Business Machines • Check Signing & Protecting Machines • Clippers for Barbers, Animal Shearing & Hedge Trimming • Cloth Cutting Machines • Coin Changers & Counters • Communication Equipment • Electric Fans • Electric Motors • Floor Polishers, Sanders, Scrubbers, Sweepers • Food & Drink Mixers, Blenders • Home Appliances • Lawn Sprinklers • Machine Tools • Meat Tenderizers, Grinders, Slicers • Military Equipment • Motion Picture Cameras & Projectors • Outboard Motors • Pneumatic Production Tools • Portable Electric Tools • Radio & Radar Tuning Assemblies • Radio Anti-backlash Gears • Record Changers • Sewing Machines • Steel Strap Stretchers • Step Switches • Tapping, Drilling & Threading Equipment • Telephone Dials • Television Sets • Thermostatic Controls • Typewriters • Vending Machines • Washing Machines.

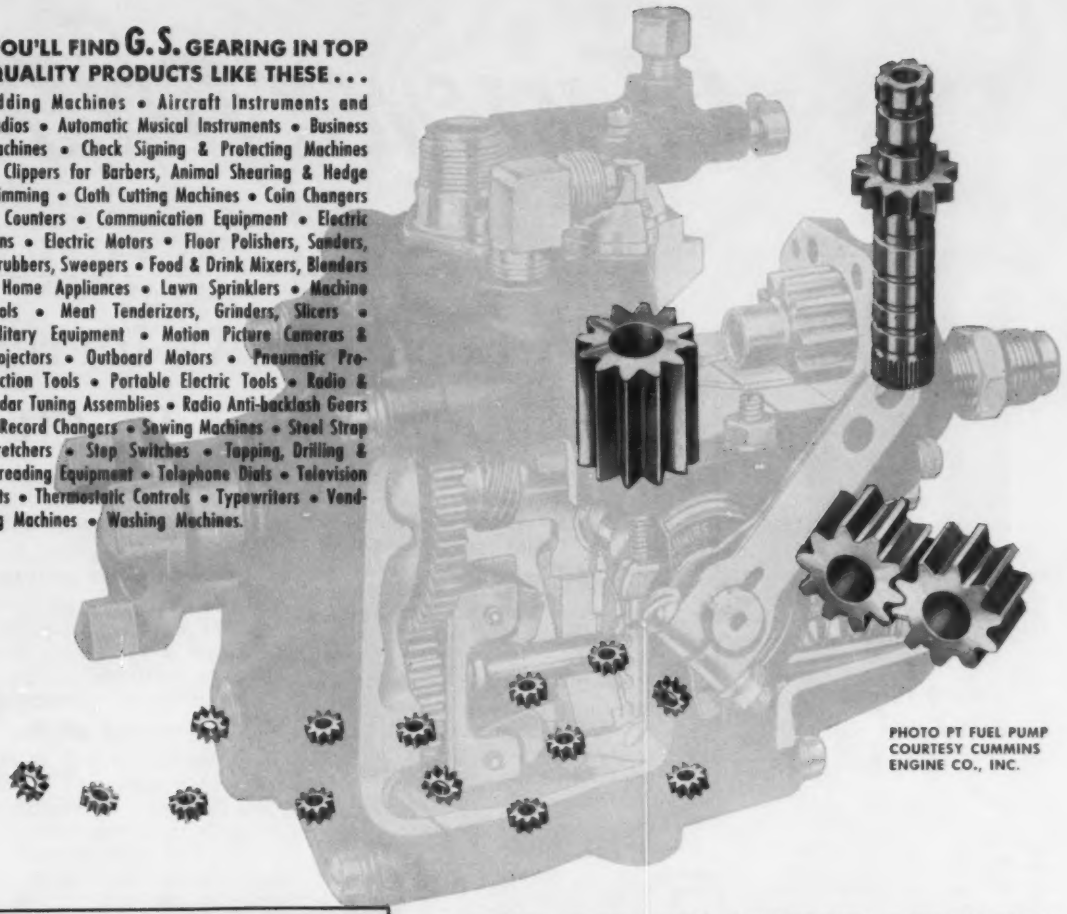


PHOTO PT FUEL PUMP
COURTESY CUMMINS
ENGINE CO., INC.

GEAR
Specialties, Inc.
2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS
OF FRACTIONAL HORSEPOWER GEARING

DIESEL FUEL AND AIRCRAFT HYDRAULIC SYSTEMS ARE MORE DEPENDABLE WITH G. S. SMALL GEARING

GEARING for Diesel Fuel and Aircraft Hydraulic Systems must measure up to the most rigid quality standards. Occasionally, a single, intricate component requires 40 or more extremely accurate operations. You see, Pump Gearing must function *without fail*, under *all* operating conditions. Utter dependability is essential. ★ G.S. Small Gearing is usually specified for mechanisms that perform perfectly *always*. Will YOU also join the fast-growing group of critical customers who come to "Headquarters" for *all* the Small Gearing they need? You'll find it pleasant and *profitable* to do this.

SEND FOR FREE *6-page Small Gearing Guide. It describes 80 types and applications. Contains useful charts . . a valuable aid to anyone interested in Small Gearing. Use company letterhead, please. No obligation, of course. Write today!*

FRACTIONAL HORSEPOWER GEARING
GS

40 Years of Specializing in Small Gearing!

R B & W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Coarse Threads Better Than Fine For Many Jobs

The load and stress concentrations on threads are lower in standard coarse thread fasteners than in fine threaded ones. Flank engagement is also greater because coarse threads are deeper. Except in such cases where fine adjustments are needed, coarse threads are, therefore, preferable to fine threads. They have greater resistance to stripping and, consequently, can be more highly torqued to make a stronger assembly.

PRODUCTION SAVINGS

Coarse thread fasteners tighten with only two-thirds the revolutions needed for fine threads. So your assembly time is faster, too. Coarse thread bolts enter nuts or mating holes with less tendency to cross thread when not truly positioned. In hard-to-reach areas, this ease of starting can often be your deciding factor. Bear in mind, too, that coarse threads need less "babying" in handling since they're less apt to be damaged.

All in all, coarse threaded standard fasteners prove best for an assembly because of their additional clamping strength—and best for the assembler because of their extra economy and production advantages.

Spin-Lock screws increase holding power by 20%

EXPERIENCE confirms that Spin-Lock screws hold tight under conditions of vibration or repeated heating and cooling. Their strong teeth have a ratchet action on the bearing surface—the acute angle lets the screw tighten fast and easily, until the teeth actually embed into the seat upon tightening, as shown in the sectional photomacrograph below. The almost vertical face of the teeth then resists counter-rotation and loosening. As a result, it takes about 20% more torque to loosen a Spin-Lock than to tighten it.

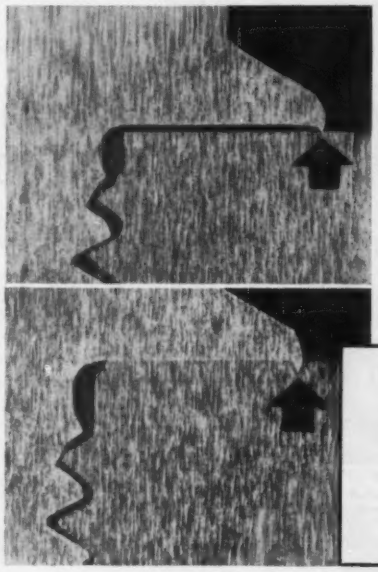
LOWER COST ASSEMBLY

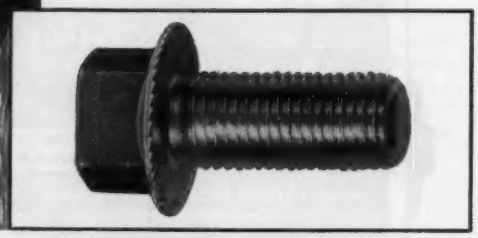
Spin-Lock screws avoid need for washers or external locking devices. One-piece construction, they allow faster assembly and can be easily handled and driven in cramped spaces.

STRONGER ASSEMBLY

Heat treatment gives the teeth hardness and toughness. Spin-Lock screws can, therefore, be reused when removed with but slight loss in holding power. The extra strength also permits tighter fastening for a stronger assembly without risk of stripping threads.

Screws with hex, pan, truss and flat heads are available. See Sweet's Product Designers file or write Russell, Burdsall & Ward Bolt and Nut Company. Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.





High strength bolts improved product at a saving

A mechanical vibrating shaker naturally suffers severe abuse itself from vibration. One manufacturer of such machines used costly special fasteners and lock nuts to control tendency of the product to loosen up.

Asked about it, RB&W recommended a standard high strength bolt, heavy nut, and two hardened washers. These permitted a high tensile clamping force to be developed. Residual tension was ample for the most severe operating conditions and kept the bolts tight. Result: A 25% saving in annual fastener cost, the constant availability of standard items, and less maintenance for the product. You too can draw on RB&W experience for technical help to assure a strong assembly and to cut costs.

For more information fill in page number on Inquiry Card, on page 263

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

PRECISION BEARINGS—McGill Mfg. Co., Inc., Bearing Division, Valparaiso, Ind. 128-page catalogue listing a complete line of precision bearings. A special feature of this catalogue is an entire section on engineering data and computations. The engineering section features a listing of formulas and complete data for use in determining numerical values for the various loads to which bearings are subjected. The formulas show how to compute horsepower and torque; how to determine values of radial and thrust loads; how to equate distribution of loads in relation to bearing location; and how to compute radial loads due to belt, chain, or rope drives. Copies of this catalogue can be obtained by writing to the above company.

ALUMINUM CASTINGS—Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Ave., Chicago, Ill. 388-page book entitled "Casting Kaiser Aluminum," containing extensive information on all phases of aluminum casting. Progressive foundry practices are fully treated with a complete analysis of aluminum casting alloys and their characteristics. The book presents data about aluminum practices used in sand casting, permanent mold casting, die-casting, shell mold casting, centrifugal casting, investment casting, and casting in plaster. Copies may be obtained free when requested on company letterhead, or at a cost of $5 for personal libraries, by addressing the Technical Editor, Department A-16, at the above address.

TOOL STEELS—Allegheny Ludlum Corporation, 2020 Oliver Bldg., Pittsburgh, Pa. 204-page handbook entitled "Tool Steel Handbook" (fourth edition). This book contains complete data on types, properties, and applications of tool steels. There are complete chapters devoted to such items as: selecting the proper steel, tool steel products, and working tool and high-speed steels. One section is devoted to informative reference tables. A copy can be obtained by writing to the Advertising Department of the above company.

TAX DEPRECIATION METHODS—Machinery and Allied Products Institute, 1200 Eighteenth St., N. W., Washington 6, D. C. Booklet based on the forthcoming publication "Business Investment Policy" in which the effect of the alternative tax depreciation methods on the after-tax return from a depreciable asset is analyzed and measured. Copies of this booklet are available on request from the above company. Single copies, $1; quantity prices on request.

AIRCRAFT FASTENERS—Aircraft Products Division, Standard Pressed Steel Co., Jenkintown, Pa. Two technical pamphlets describing the company's high-strength, steel aircraft bolts having a minimum tensile strength of 220,000 pounds per square inch; and high-strength self-locking lock-nuts designed for use with the bolts. Designated Hi Psi EWB-22, the bolts are described in detail in a 12-page pamphlet which gives tension-tension fatigue charts and tensile and shear strength graphs. Cut-away photographs show how the EWB-22 bolt, the EWN-22 nut, and the company's preload indicating (PLI) washer operate together as an aircraft assembly unit. Companion pamphlet describing the EWN-22, high-strength lock-nuts gives complete specifications for all sizes. . . 1

SMALL TOOLS—Cleveland Twist Drill Co., Cleveland, Ohio. 206-page book describing the company's complete line of "Cleveland" tools. Illustrated and listed in this catalogue are twenty-nine new tools, including carbide-tipped and solid carbide end-mills, carbide-tipped die drills, solid carbide short series straight shank drills in fraction, wire gage and letter sizes, and Mo-Max T-shape cut-off blades, available in both regular Mo-Max and Mo-Max cobalt steels. The catalogue also lists thirteen new drill sets. Step-cut thumb indexing with colored tabs makes it easy to locate each of the fourteen main sections. The tools in each section are conveniently grouped for quick reference. 2

RESISTANCE WELDING—Sciaky Bros., Inc., Chicago, Ill. Booklet entitled "Resistance Welding at Work," covering the use of the company's resistance welding techniques to fabricate miter-joint aluminum window frames. These joint frames were formerly fastened by arc-welding which did not always provide a watertight joint. Two of the company's Type BMW-1 200 KVA flash-butt welders are now being used. Other sections of this bulletin illustrate and describe a sequence of operations with this fastening technique. 3

CHUCKS—Cushman Chuck Co., Hartford, Conn. 91-page catalogue 66-1956, listing the company's complete line of manually operated chucks. Included are detailed dimensional drawings, dimensions for all chucks, and a list enabling easy selection of chucks. In addition to the inclusion of a new series of airtight chucks, an entire section of the catalogue is devoted to descriptions of the many special-purpose chucks and Accra-Set

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chucks engineered and designed by the company. 4

EXPLOSION-PROOF MOTORS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Catalogue 51B7286G, describing the company's explosion-proof motors in NEMA rerated ratings of 1/2 to 30 H.P. New features include a diagonally split cast-iron conduit box for increased accessibility and ease of wiring, and a rotating shaft seal on the shaft extension end of a material impervious to corrosive agents. In addition to cut-away views of the motors, the bulletin includes tables of ratings and dimensions, as well as a horsepower frame chart. 5

MILLING MACHINE SELECTOR—Greaves Machine Tool Division, J. A. Fay & Egan Co., Cincinnati, Ohio. "Slide-Guide"—a unique device providing at-a-glance comparisons of twenty-one essential specifications to be considered in purchasing a milling machine. The slide-rule shows specifications for eight leading mills. Table sizes, speeds, feeds, capacity data and power specifications are among the detailed information provided. 6

CONVEYORS—Hapman Conveyors, Inc., Kalamazoo, Mich. Bulletin H-656, describing the company's heavy-duty pan-link conveyor for heavy items such as spiral metal turnings, stampings, castings, forgings, etc. No conventional chain is included in the design. This construction is said to be especially advantageous when carrying abrasive materials, as it eliminates abrasion and rapid wearing out of pans through rubbing against each other. Coolant fluids can also drain out between pans. 7

CUTTING TOOLS—Metal Carbides Corporation, Youngstown, Ohio. 12-page catalogue describing the company's aluminum oxide cutting metals, tool tips, throw-away inserts, cylinders, and other machine turning and cutting tools. Catalogue includes technical data on aluminum oxide, recommended applications and machining practice, dimensions of standard tools, and instructions for grinding them. 8

MOTORS—General Electric Co., Schenectady, N. Y. Bulletins GEC-1026A and GEC-1027A, giving buying information on a selected group of the company's motors. Included are application data, ratings, and prices for fractional-horsepower motors; integral horsepower polyphase and single-phase induction motors; motors and control for part-winding starting; gear-motors; and resilient-base, integral horsepower induction motors. 9

RADIAL ROLLER BEARINGS—Rollway Bearing Co., Inc., Syracuse, N. Y. 56-page catalogue-manual entitled "Precision Radial Roller Bearings." In addition to comprehensive tabular information on radial static and dynamic capacities, the catalogue introduces the thrust capacities recently computed for the company's complete line of maximum type precision radial roller bearings. 10

THERMOCOUPLES — Thermo Electric Co., Inc., Saddle Brook, N. J. 10-page bulletin describing the company's miniature bayonet thermocouples. These are embedded, bayonet-lock units with spring loaded contacts. Applications include temperature measurement of engine and pump cylinder heads, turbine housings, pipes, electric motors, generators, transformers, plastic extruders, and molding machines. 11

BROACHING MACHINES—Colonial Broach & Machine Co., Detroit, Mich. Bulletin HM-56, giving mechanical details and operating advantages of the ElectroGear line of horizontal guided-ram type surface broaching machines. Bulletin lists machine data for twelve models in the line that have normal capacities of 10, 15, 20, and 25 tons, and stroke lengths ranging from 90 to 240 inches. 12

AIR GAGES—Sheffield Corporation, Dayton, Ohio. 12-page catalogue describing the principles of air gaging with the company's column Precisionaire. Described also are basic tooling for inspecting internal and external dimensions and conditions, and types and sizes of adjustable air gage tooling. Many illustrations of single- and multi-dimension Precisionaire gage applications are included. 13

FORGINGS AND CASTINGS—Allegheny Ludlum Steel Corporation, Detroit, Mich. 30-page catalogue giving complete data on smooth hammered forgings, composite die sections, cast-to-shape tool steels, and a new steel finder which gives detail information on the various forging and casting steel grades made by the company's Forging and Casting Division. 14

RADIAL-DRAW FORMERS—Cyril Bath Co., Solon, Ohio. 60-page catalogue containing examples with illustrations and diagrams of radial-draw forming machines that will handle work up to 300 or more tons, down to semi-automatic radial-draw forming machines that will produce work for automobile trim at the rate of 600 pieces per hour. 15

BORING TOOLS—Moore Special Tool Co., Inc., Bridgeport, Conn. 12-page catalogue describing a complete line of boring tools for toolroom or production use. Also described is the company's boring chuck set which will bore any size hole from 5/32 inch to 5 inches. Design features of this chuck are illustrated and described. 16

LOCKWASHERS—Pioneer Stamped Products Co., Rochester, N. Y. Catalogue describing the company's spring steel lockwasher which features, in addition to the locking action, a tight vibration-dampening grip on the screw itself. These fasteners are stamped or formed from flat strip rather than machined or formed from solid rod or wire. 17

CENTERLESS BRUSHING—Osborn Mfg. Co., Cleveland, Ohio. 4-page brochure—illustrated with photographs and a brush specification chart—giving information on how to reduce down time on centerless grinders by extending their use to precision brush finishing on cylindrical parts. Types of finishing possible, and

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characteristics of brushes needed, are described. 18

NYLON BOBBINS AND WASHERS—Cosmo Plastics Co., Cleveland, Ohio. 4-page technical bulletin containing maximum and minimum wall thicknesses, core lengths, core sizes, and flange sizes of nylon bobbins; and maximum and minimum thicknesses, outer and inner diameters, and tolerances of nylon washers for a wide range of electrical uses. 19

METAL SHEET FEEDER—Dexter Folder Co., New York City. 6-page folder describing the company's 150-sheet-per-minute metal sheet feeder. The feeder handles sheets ranging in size from 19 by 19 inches up to 36 by 44 inches, and from 38 to 20 gage thick. The machine supports loads weighing up to 9000 pounds. 20

MAGNETIC FORCE WELDERS—Precision Welder & Flexopress Corporation, Cincinnati, Ohio. Bulletin MF-100, covering the magnetic force welders used in joining difficult-to-weld materials. Also, light initial electrode pressure permits projection welding on materials whose projections would collapse under conventional electrode pressure. 21

ROTARY FINISHER AND BUFFER—Mathewson Machine Works, Inc., Quincy, Mass. Leaflet giving full details on the company's rotary finisher and buffer with disc attachment built for abrasive finishing, burring, sanding, buffing and polishing on metal, wood, fiber, plastics, etc. 22

HEAT EXCHANGERS—Alco Products, Inc., Schenectady, N. Y. Bulletin FH-3 describing the company's Alcotwin fin-tube heat exchangers. The bulletin describes the heat-transfer characteristics of the longitudinal fin tubes which feature U-shaped fin channels integrally bonded to the tubes by heliarc-welding. 23

POWDER METAL PRESSES—Powder Metallurgy Division, F. J. Stokes Corporation, Philadelphia, Pa. Catalogue 815, describing the company's entire line of powder metal presses, comprising thirty-seven different models ranging in capacity from 1 1/2 to 300 tons, and including both single-punch and rotary types. 24

ELECTRIC THRUST MECHANISM—General Electric Co., Schenectady, N. Y. 8-page bulletin describing the company's Thrustor mechanism. Operations of these units are described, and general features as well as features for special applications and eight typical applications of the unit are given. 25

PROXIMITY SWITCH—Doelcam, A Division of Minneapolis-Honeywell Regulator Co., Boston, Mass. Bulletin PS, describing the company's proximity switch Model T-271. This switch is a magnetic device with no moving parts, used to detect the presence of a ferrous object without requiring physical contact. The object passes through a magnetic field. 26

PLASTIC TOOLING—Marblette Corporation, Long Island City, N. Y. 8-page catalogue entitled "The Marblette Digest of Plastic Tooling," giving information on existing applications of plastic tooling for metal- and plastics-forming and on foundry practice. 27

FLUSH PIN AMPLIFIER—Holmes Gage & Development Corporation, Columbus, Ohio. Catalogue No. 1 describing the mechanical features of the company's flush pin amplifier. Principle component parts are shown by nomenclature and operation is illustrated. 28

GEAR-GRINDING MACHINE—Sheffield Corporation, Dayton, Ohio. Catalogue GG-55 describing the company's Model 140 reciprocating gear-grinding machine designed for grinding external precision spur, and both right- and left-hand helical gears from 8 to 100 pitch. 29

MOTOR PULLEY—Reeves Pulley Co., Division of Reliance Electric & Engineering Co., Columbus, Ind. Catalogue V-563, describing the design features of the company's 800 series Reeves Jr. motor pulleys available in horsepower capacities from 1/4 to 1 1/2, and in speed ratios up to 2.75:1. 30

TOOL-HOLDERS—Besly-Welles Corporation, South Beloit, Ill. Catalogue 852C listing the company's complete line of tool-holders and triangular and square throw-away carbide inserts. These mass-produced tools and edges are said to reduce production costs and increase cutting efficiency. 31

WELDING FITTINGS—Tubular Products Division of Babcock & Wilcox Co., Beaver Falls, Pa. 6-page folder FB-502, describing the full line of carbon, alloy, and stainless-steel seamless welding fittings and forged steel flanges. 32

HYDRAULIC EQUIPMENT—Oilgear Co., Milwaukee, Wis. 23-page catalogue describing the company's products, and

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some of their uses. Photographic illustrations introduce the precision machines used in the manufacture of Oilgear products. 33

VIBRATION-CONTROL MOUNTINGS—Korfund Co., Inc., Long Island City, N. Y. 8-page bulletin giving case histories showing how production can be increased with the company's vibration- and noise-control machinery mountings. 34

GROOVED FASTENERS—Driv-Lok Pin Co., Sycamore, Ill. 24-page catalogue describing the company's grooved fasteners used in practically every type of product. 35

ROTARY CUTTING TOOLS—Elgin National Watch Co., Elgin, Ill. Brochure describing the company's complete line of solid carbide end-mills, rotary files, and miniature cutters. 36

MULTIPLE-SPLINE SOCKET SCREWS—Bristol Co., Waterbury, Conn. 6-page bulletin entitled "Why A Multiple-Spline Socket Screw," explaining the reasons for using the multiple-spline power transmission in a socket screw. 37

VALVES—Fulflo Specialties Co., Inc., Blanchester, Ohio. Mechanical Data Book containing technical information on the installation and maintenance of oil-relief, by-pass hydraulic valves. 38

ALUMINUM—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin entitled "Aluminum in Stock at Ryerson," covering the company's new stocks of Reynolds aluminum. 39

SPRAY VALVES—Farval Corporation, Cleveland, Ohio. Bulletin 60-A, giving complete description of the company's spray-lubrication equipment for heavy open gearing and slide surfaces. 40

THERMOSTATIC CONTROL VALVES—Lawler Automatic Controls, Inc., Mount Vernon, N. Y. Bulletin C-7, describing the company's line of thermostatic control valves. 41

VISES—American Positive Grip Vise Corporation, Willimansett, Mass. Illustrated folder describing the company's variable grip vise for all shapes and contours. 42

AUTOMATIC MACHINERY DESIGN—Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill. 12-page catalogue describing the Foundation's facilities and its activities. ...43

MASKS AND STENCILS—Gleicher Mfg. Corporation, Newark, N. J. 4-page brochure describing the company's precision die-cut pressure-sensitive tape masks and stencils for specific applications. 44

TUBING ALLOYS—Superior Tube Co., Norristown, Pa. Data memorandum No. 1 listing 121 metals and alloys from which the company produces its standard and special small-diameter tubing. 45

PRECISION BALLS—Universal Ball Co., Willow Grove, Pa. Catalogue describing the company's precision balls made in a number of sizes and of various materials for a wide range of industrial applications. 46

PNEUMATIC DIE CUSHIONS—Dayton Rogers Mfg. Co., Minneapolis, Minn. Bulletin describing the company's improved Model HD pneumatic die cushion. 47

FLUID DRIVE—American Blower Corporation, Detroit, Mich. Bulletin 9819, describing the company's 1- through 25-H.P., Type VS, Class 2 Gyrol fluid drives. 48

CARBIDE TOOLS — Chicago-Latrobe, Chicago, Ill. 16-page catalogue showing the company's complete line of carbide tools, together with technical data. 49

DRILL-PRESS POSITIONER—Bayer Industries, Phoenix, Ariz. 4-page catalogue describing the company's drill-press positioner. 50

DELAYED CONTROL UNITS—Automation Inc., Wellesley Hills, Mass, 4-page folder describing the company's delayed control units. 51

TEST INDICATORS—George Scherr Co., New York City. Leaflet describing the company's "Puppitast" universal test indicators. 52

HYDRAULIC PRESSES—Hydraulics Division, K. R. Wilson, Inc., Arcade, N.Y. Illustrated folder describing the company's hydraulic presses. 53

HEXAGON HEAD CAP SCREWS—Cleveland Cap Screw Co., Cleveland, Ohio. 24-page price list covering the company's products. 54

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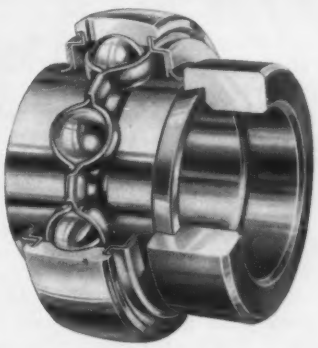
NEW! Fafnir Wide Inner Ring Ball Bearings with PLYA-SEALS . . . *contact type*

A most important feature *. . . on slow-speed applications where service conditions are excessively dirty and moist*

RCJ Flange Cartridges
(Standard Series)



RAK, RAS Pillow Blocks
(Standard Series)

Plya-Seal Construction
— for wide inner ring ball bearings. A synthetic rubber, contact-type seal located between two "dished" steel plates for extra rugged support.

With the addition of this version of PLYA-SEALS to the Fafnir line of wide inner ring ball bearings, you can be more selective in the type of sealed bearing you specify and install. Where service at slow to moderate speeds demands most effective protection against contaminants, especially air-borne dust, dirt and grit, the Plya-Seal type offers the advantages of contact seals, tested and proven by years of service.

Plya-Seal Wide Inner Ring Bearings are optional on the standard series Pillow Blocks and Flange Cartridges. They are dimensionally interchangeable with the Fafnir Mechani-Seal. Flared lip and clearance between inner supporting seal member and inner ring O.D. keeps seal from pushing in. Plya-Seals do not absorb contaminants, thus their surface won't glaze and lose its efficiency. *Fafnir Wide Inner Ring Bearings equipped with Plya-Seals are relubricatable!*

Here's an opportunity to improve operations, reduce servicing, eliminate loss of lubricant, provide the most effective protection from contaminants. For new Bulletin on Plya-Seal Wide Inner Ring Ball Bearings, ask your Authorized Fafnir Distributor or write The Fafnir Bearing Co., New Britain, Conn.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

For more information fill in page number on Inquiry Card, on page 263

1946 when he started as assistant to the sales manager.

HENRY A. LUNDY has been elected vice-president of Hardinge Brothers Inc., Elmira, N. Y. At the same time it was announced that JAMES P. WAGNER has been appointed advertising manager.

AMERICAN BRAKE SHOE CO., New York City, announces that the Denison Engineering Co., with main offices in Columbus, Ohio, a wholly owned subsidiary since 1955, became a division of the company.

PAUL J. CHANEY has been appointed commercial products sales manager of the Metals Processing Division, Curtiss-Wright Corporation, Buffalo, N.Y.

WATERBURY BRASS GOODS DIVISION of the American Brass Co., New York City, has changed its name to the FABRICATED METAL GOODS DIVISION.

LEONARD GOLAND has been appointed director of research at Kellett Aircraft Corporation, Camden, N. J. Mr. Goland was formerly a chief project engineer at Forrestal Research Center and instructor in the graduate school, Princeton University; and head of the engineering analysis section of Reaction Motors, Rockaway, N. J.

LEWIS W. MACNAUGHTON was elected chairman of the board of Isotopes, Inc., Westwood, N. J.

ROGER BYRNES has been appointed midwestern district manager for the Adamas Carbide Corporation, Kenilworth, N. J.

Ohio

R. F. MYERS has been appointed sales manager of the Machinery Manufacturing Division of the Motch & Merryweather Machinery Co., Cleveland, Ohio. At the same time it was announced that RAY G. KNAPP, JR. was named assistant to the sales manager. C. H. PRIEFER will be district sales manager for the company's four branch offices. DAVID S. BAUS will be district manager for the territory including the Eastern seaboard, New York State, and eastern Pennsylvania.

E. W. BLISS CO., Canton, Ohio, has acquired from the American Flexible Coupling Division of Zurn Industries Inc., Erie, Pa., exclusive rights to the manufacture and sale of the patented, fully crowned tooth gear type coupling specially engineered and applied to rolling mill equipment, their allied auxiliaries, and other manufacturing machinery.

BAKER BROS., INC., Toledo, Ohio announces the appointments of two regional sales managers—A. G. WARREN and J. P. NUGENT. Mr. Warren has his headquarters at Syracuse, N. Y., and Mr. Nugent in Dearborn, Mich., covering the regions of eastern Michigan and Windsor, Ontario, Canada.

U. S. DRILL HEAD CO., Cincinnati, Ohio, announces that the WALTER F. CAHILL CO. will be its exclusive representative throughout the State of Michigan. Cahill offices are located at 19030 W. McNichols Road, Detroit, Mich., and at Box 289, Grand Rapids, Mich.

SHEFFIELD CORPORATION, Dayton, Ohio, announces the establishment of a research and development division devoted exclusively to instruments, controls, machines, and systems for "autometrology"—combining machining, motion, or memory with automatic measuring.

FOSTER H. PETTAY has been elected president of the Ohio Crankshaft Co., Cleveland, Ohio. At the same time it was announced that M. J. HOKE was elected senior vice-president and general manager, and PAUL T. KOENIG secretary and treasurer of the company. Mr. Pettay, who joined the company in 1941 as assistant secretary, served in a number of top executive positions before assuming leadership of the firm. Mr. Hoke was formerly vice-president and general manager of the company's Camshaft and Crankshaft Division. Mr. Koenig joined the company in 1941 as an accountant.

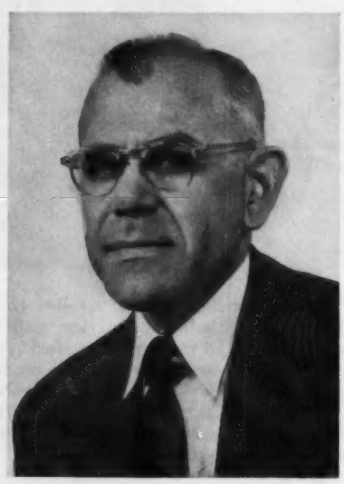
ROBERT A. COLE has been appointed sales manager for the Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. Mr. Cole was with Bryant Machinery and Engineering Co. for eleven years, and was vice-president and sales manager before he joined Cincinnati Gilbert.

DIAMONITE PRODUCTS DIVISION, U. S. Ceramic Tile Co., Canton, Ohio, announces the appointment of FAYJAN TOOL SALES CO., P. O. Box 843, Williamsport, Pa., as representative for their line of oxide cutting tools.

WARNER & SWASEY CO., Cleveland, Ohio, is planning to spend some $2,800,000 for the construction of additional manufacturing space and the acquisition of additional machinery and equipment.

M. E. DORMAN has been appointed manager of dealer and accessory sales for the die supply division of E. W. Bliss Co., Canton, Ohio. Mr. Dorman has been with the company for sixteen years.

DONALD D. PHILLIPS has been appointed sales representative in northwestern Ohio for the R. K. LeBlond Machine Tool Co. of Cincinnati, Ohio. Mr. Phillips has been with the company for 27 years.



(Left) Foster H. Pettay, president and (right) M. J. Hoke, senior vice-president and general manager of Ohio Crankshaft Co.

(This section continued on page 270)

Exactly the Power You Need

Range of horsepower, stroke, spindle speed and thrust in Ex-Cell-O Quill Type Power Units

Ex-Cell-O Hydraulic Power Units come in sizes suitable for a wide range of applications. Compact design makes it possible to place them at close center distances either in line or radially around a fixture. No matter what the application, you get smooth, dependable operation.

Used in drilling, counterboring, spot-facing and reaming operations, these hydraulic power units can be designed into special-purpose machines with easily controlled automatic cycles. Units can later be re-arranged to perform different machining operations.

You can install these power units easily. They'll stand up under fast cycles and continuous operation; they're self-lubricated.

For complete information ask your Ex-Cell-O representative or write Ex-Cell-O in Detroit.

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DETROIT 32, MICHIGAN

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-45

JACK P. ANDERSON has been named chief industrial engineer of the Lunkenheimer Co., Cincinnati, Ohio.

JOSEPH FOSTER has been appointed manager of the Brush Electronics Co.'s market research department, Cleveland, Ohio.

Pennsylvania and Maryland

STANDARD PRESSED STEEL CO., Jenkintown, Pa. announces the following appointments: ROBERT A. REESE was promoted to sales manager of the Syracuse, N. Y. district and EDWARD D. OTTO was named salesman in the same district. Mr. Reese's district encompasses all of New York State outside the metropolitan area of New York City. As district sales manager, he replaces LEONARD H. CLARK, recently named to the post of assistant to the vice-president of sales.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa. announces the following appointments: F. PRICE NORRIS, JR., assistant to the vice-president in charge of sales, on special assignments; C. R. MITCHELL, JR., director of sales, stainless and specialty steels; and RICHARD D. MERCER, assistant to the director of sales, stainless and specialty steels, assigned to sheet and strip duties. Mr. Norris, who has been with the company since 1936, was formerly director of stainless-steel sales.

BALDWIN-LIMA-HAMILTON CORPORATION announces that JOHN J. LITTLEY and BYRON B. BELDEN have been transferred from the Eddystone, Pa., Division to the Hamilton, Ohio, Division. Mr. Littley will serve as sales manager of hydraulic and compacting presses. Mr. Belden will serve as application engineer for Baldwin compacting presses.

JOHN WAMBOLD has joined the research staff of Kennametal Inc., Latrobe, Pa., as a metallurgical engineer. For the past six years, Mr. Wambold was associated in a similar capacity with the Curtiss-Wright Corporation.

R. C. COLBAUGH has been appointed assistant vice-president of industrial engineering of United States Steel Corporation, Pittsburgh, Pa. At the same time, it was announced that C. W. IAMS will succeed Mr. Colbaugh as assistant to general manager operations—steel.

G. E. HUTCHINSON has been appointed to the newly created position of manager of quality control of Rem-Cru Titanium, Inc., Midland, Pa.

SAMUEL STORCHHEIM was appointed chief of manufacturing engineering and research in the Nuclear Division of the Martin Co., Baltimore, Md.

Coming Events

OCTOBER 8-12—National Metal Congress and Exposition sponsored by the AMERICAN SOCIETY FOR METALS to be held at the Cleveland Public Auditorium and Exhibition Hall, Cleveland, Ohio. All equipment and new developments introduced by exhibitors will stress the "spend to save" theme. Further information can be obtained from W. H. Eisenman, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 22-26—NATIONAL INDUSTRIAL EXPOSITION to be held at Artillery Armory, 8 Mile Rd., Detroit, Mich. Top executives and organizations in industry and local governments are the sponsors in cooperation with the United States Departments of Commerce and Defense. Chairman of the Committee is Leeland M. Uhl. Exposition headquarters is at 927 Book Bldg., Detroit, Mich.

NOVEMBER 26-30—TWENTY-SECOND NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING under the auspices of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held at the New York City Coliseum in conjunction with the Society's seventy-sixth annual meeting. As heretofore, it will be under the management of the International Exposition Co.

• • •

New cars have increased use of aluminum castings, particularly in the transmission section, according to Fabricast Division of General Motors. These castings are produced by semi-permanent mold, permanent mold, and die-cast processes. Emphasis is placed on increased usage of aluminum die-castings in applications which, in some instances, replace cast iron. The trend toward decreased weight in cars reflects a continuing improvement in the future of the aluminum foundry.

Obituaries

A. E. Maillard-Rousseau

A. E. Maillard-Rousseau, Directeur General and Editor-in-Chief of the well-known French metalworking publication, LA MACHINE MODERNE, died in La Baule, Brittany, France, on August 26.

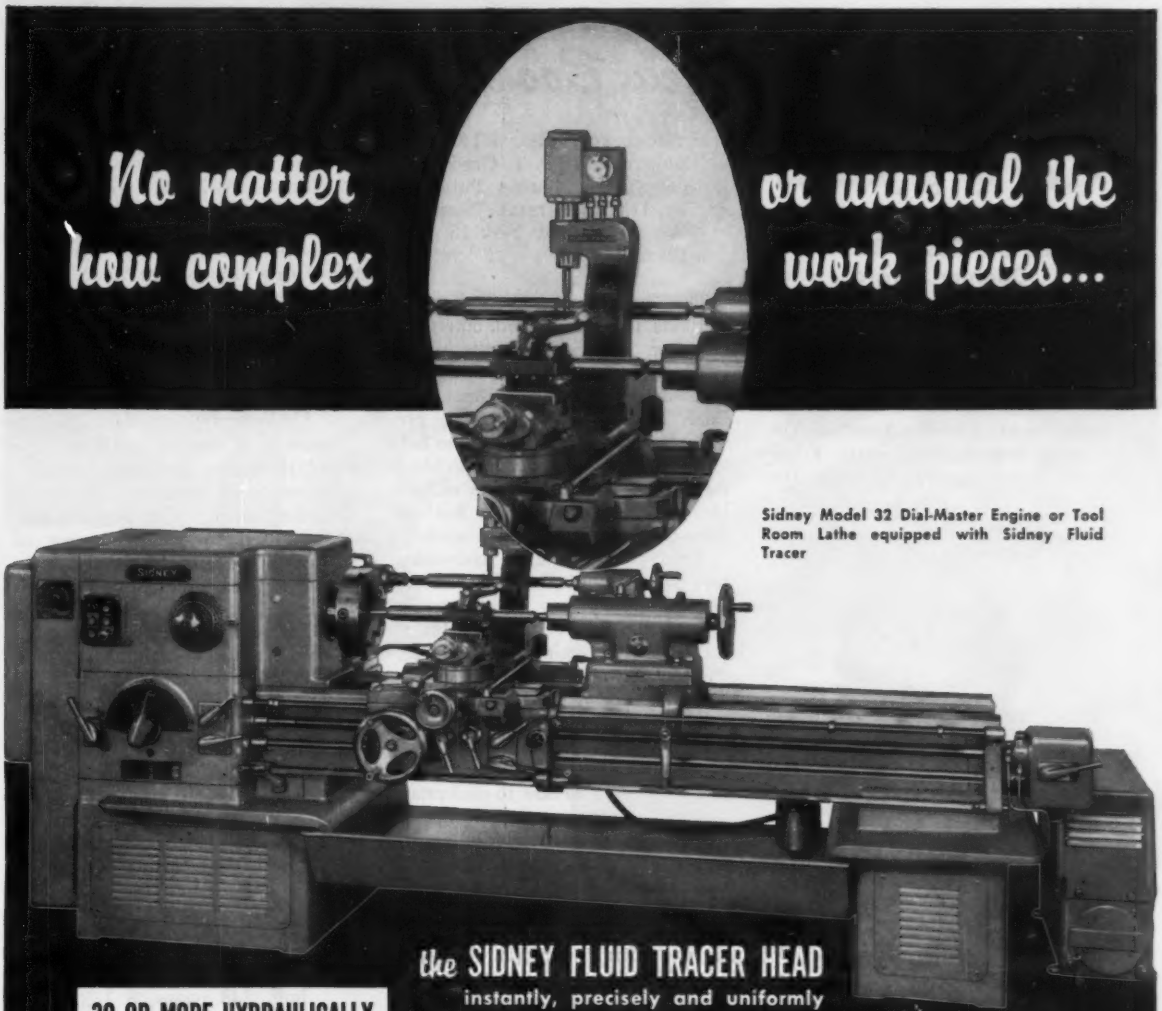
After graduation from the School of Engineers of the Industrial Institute of the North of France, M. Rousseau was employed in the Compagnie Electro Mecanique until the outbreak of World War I, during which he served in the infantry and was awarded the Croix de Guerre.

Taking over the direction of LA MACHINE MODERNE in 1919, this publication was built up from modest beginnings to one of the leading French technical journals. In 1936, he was one of the few French engineers to visit the U.S.S.R. During World War II, the publication of LA MACHINE MODERNE was suspended for the greater part of the German Occupation and when later it was allowed to appear all propaganda material was refused. On that account, LA MACHINE MODERNE was the first technical journal to receive official authorization for publication after the Liberation.

M. Rousseau was well known in the metalworking field generally as well as in the French machine tool industry where he was held in high regard. He was a man of wide accomplishments and, consequently, his activities covered a broad field. He was a Chevalier of the Legion of Honor and held a decoration in the field of education. His personality inspired affection as well as respect and he will be greatly missed by a large circle of associates and friends.

(This section continued on page 272)

No matter how complex or unusual the work pieces...



Sidney Model 32 Dial-Master Engine or Tool Room Lathe equipped with Sidney Fluid Tracer

30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 . . . used regularly as a standard SIDNEY feature ever since. But only recently adapted by other lathe manufacturers . . . a fitting tribute to SIDNEY pioneering and leadership.

the SIDNEY FLUID TRACER HEAD

instantly, precisely and uniformly transfers every change in contour from the master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

THE SIDNEY FLUID TRACER can be furnished in connection with any size or model of SIDNEY LATHE. Small runs or quantity production runs show tremendous savings in cost per finished piece. Changeover to standard lathe operation or back to tracer control requires just a few seconds. No addition or removal of parts is necessary because the tracer motor may be turned off while the lathe does standard lathe work.

IT'S "SUPER" IN EVERY WAY

SUPER SWIFT...

SUPER ECONOMICAL...

SUPER SENSITIVE!

Look at what work you can turn with the SIDNEY FLUID TRACER attachment:

Write for new bulletins or ask for representative to call

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

ARTHUR J. BOYER, a sales representative since 1944 for E. F. Houghton & Co., Philadelphia, Pa., died on August 20 at the age of sixty-seven years.

* * *

Noted Die-Caster Receives Doehler Award

Austin T. Lillegren, vice-president of the Madison-Kipp Corporation, Madison, Wis., received the highest prize of the die-casting industry—the Annual Doehler Award—at the recent meeting of the American Die Casting Institute held at the Edgewater Beach Hotel in Chicago. The

Austin T. Lillegren, vice-president of the Madison-Kipp Corporation, who recently received the Annual Doehler Award.

award was given to Mr. Lillegren in recognition of his outstanding contributions to the die-casting industry during the past year.

Mr. Lillegren has been in the die-casting business for thirty-eight years, having been associated with the Madison-Kipp Corporation since 1918. He has been a director of the American Die Casting Institute since 1949 and served as president from 1951 to 1953. Since 1953 he has been chairman of the board of the Die Cast Research Foundation.

Mr. Lillegren is of Swedish descent and is famous among friends as a raconteur of Scandinavian stories. His hobbies include ice skating and ice-skate sailing, in which he can conveniently indulge from his backyard since his home is located directly on one of Madison's lakes.

New Books and Publications

ELECTRICAL TESTING AND TROUBLESHOOTING. By P. T. Green. 200 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N.Y. Price, $4.

This book covers a variety of methods for testing and correcting faults in electrical circuits of all kinds, including controllers, motors, transformers, and transmission lines. Each of the troubleshooting procedures has been proved in the field to be a great time saver, particularly for locating obscure sources of trouble. The text presentation has also been tried out in classroom work.

Through the use of convenient step-by-step methods, information is presented that has been used by men in the field responsible for installation and maintenance of electrical equipment.

A basic knowledge of simple arithmetic is sufficient background for understanding the text and for using the procedures described. After a simple briefing on how to understand electrical symbols and drawings, the subjects presented include: analyzing and charting controller operation; troubleshooting test equipment; insulation testing; locating grounds; electromagnet windings; direct-current machine windings; single-phase transformers; phase sequence; poly-phase transformers; induction motors; synchronous motors; power cable faults; and bearing lubrication. Each subject includes adequate reference to applicable codes and standards.

Ideas presented in Chapter 2 are especially useful where outage of a complicated controller is serious enough to warrant charting information in advance of an outage.

An important feature of the tests described is that they are performed with the equipment isolated from the power line. Current for testing is supplied by dry cells or residual magnetism so that accidental contact or short circuits are less hazardous to men and machines.

This book should prove a useful guide for practicing electricians and a basic text for those in training.

AMERICAN STANDARD HEXAGON HEAD CAP SCREWS, SLOTTED HEAD CAP SCREWS, SQUARE HEAD SET SCREWS, AND SLOTTED HEADLESS SET SCREWS (ASA B. 18.6. 2-1956). 21 pages, 8 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.50.

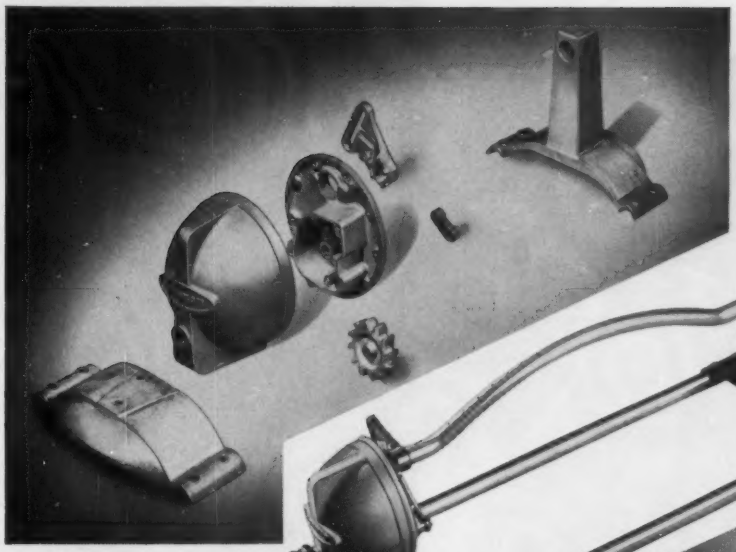
A MANUAL OF PROGRESS: FOR THE COLD BENDING OF METALS AND ABRASIVE CUT-MACHINING OF METALS. 170 pages, 9 by 6 inches. Prepared by Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, Ill. Price, $2.50.

Manual of cutting and bending—two little known processes. The section on cold bending of metals describes the types of bending machines used for cold bending of tubing, piping, and structural shapes; the tools for bending; designing for bending; theory of cold bending and many other chapters pertaining to cold bending of metals.

The abrasive cut-machining of metals deals with why abrasive wheels fail—sometimes, and how to prevent this failure; and what abrasive cut-machining will do. There are many illustrations, graphs, and charts. A valuable guide for users and potential users of bending equipment or abrasive cutting equipment.

ELEVATED-TEMPERATURE PROPERTIES OF COPPERS AND COPPER-BASE ALLOYS. Prepared by Clair Upthegrove and Henry L. Burghoff. 248 pages, 8 1/2 by 11 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. Price, $5.50.

Report prepared under the auspices of the Data and Publications Panel of the ASTM-ASME Joint Committee on the effect of temperatures on the properties of metals. This report is primarily a graphical summary of the elevated temperature data for coppers and copper-base alloys. Data for the coppers are limited to the wrought materials, while data for the alloys apply to cast and wrought materials. Included in the appendix are data sheets giving the original data for drawing curves. Also included are data sheets giving insufficient information for plotting or of such a nature as to not justify plotting, but meriting inclusion on the basis of contributing to the limited information available on many of the coppers and copper-base alloys. Chemical composition, shape, sizes, and processing information are also given.



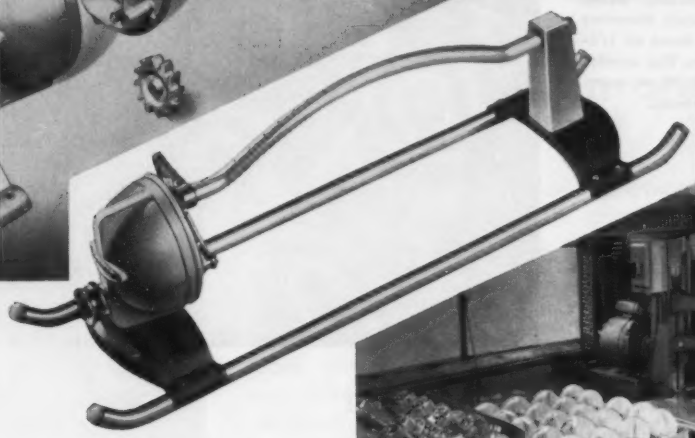
PRODUCTION SHORT CUTS

WITH

ZINC

DIE CASTINGS

NUMBER 4
OF A SERIES



A back and forth motion of the Swingin' Spray sweeps a uniform rain-like spray over a rectangular area of up to 2400 sq. ft. Its "Perma-Sealed" motor unit completely separates the water flow from the motor. Grit and dirt stay out—lubrication stays in!

Covering the ground at MELNOR

Melnor's Swingin' Spray oscillating lawn sprinklers were designed to be sold with a year's unconditional guarantee. This means, of course, that they have been built to high engineering and manufacturing standards. Thus the selection of ZINC Die Castings for seven of the principal assembly components is of special significance.

Because of the unusual contours of the components illustrated, it is obvious that die casting is the most practical method of production. And, when all of the requirements of strength, weight and corrosion resistance were fully considered, Melnor engineers found that ZINC alloy was the metal that would do the job best—at lowest cost. All holes, recesses and projections are obtained in the casting operation, thus greatly minimizing secondary work prior to assembly, and the smooth, as-cast surfaces of four of the parts are easily and economically coated with bright yellow and dark green enamels.

Send for your copy

The production and sales advantages imparted to this motor-driven sprinkler by ZINC Die Castings are typical of those found in a wide variety of products. For 80 additional examples send for our booklet "The End Uses of Zinc Die Castings" and ask any commercial die casting company for die casting design assistance to improve *your* products.

ZINC
FOR DIE CASTING ALLOYS

The New Jersey Zinc Company, 160 Front St., New York 38, N. Y.

The research was done and the Zamak die casting alloys were developed with

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

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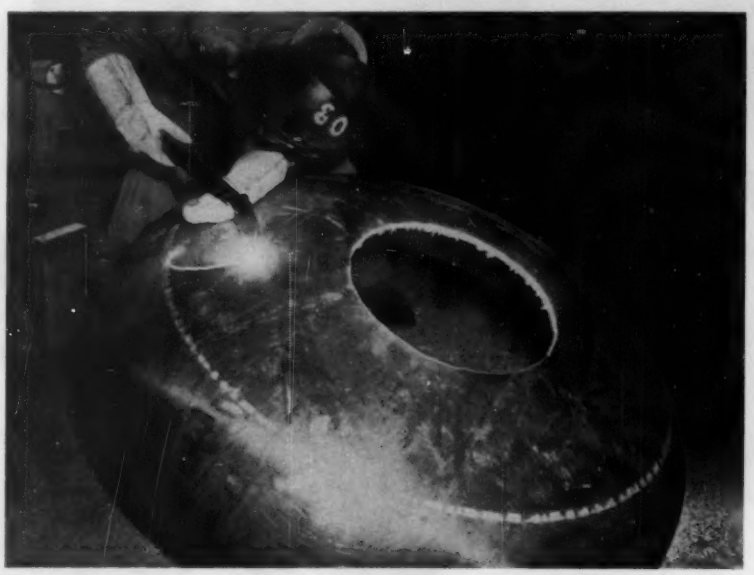


Manual Heliarc cutting being used to cut an 11-inch diameter hole in a tank car dome of 5/8-inch thick aluminum. The smaller hole (left) is cut in three quarters of a minute.

Heliarc Cutting Lowers Cost of Aluminum Tank Production

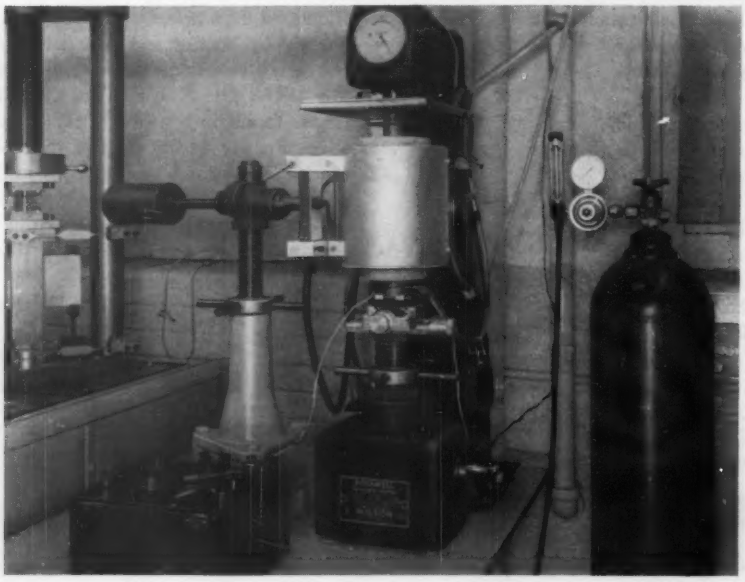
Introduced less than one year ago, Heliarc cutting has proved a successful process for shaping non-ferrous metals. Field applications, such as those found at Graver Tank & Mfg. Co. in Edge Moore, Del., have lowered production costs and raised product output. Manual and mechanized Heliarc cutting are used to shape various parts of the aluminum tanks and tank cars fabricated in the plant. The illustration shows an 18-inch diameter hole in a 5/8-inch thick aluminum tank car dome. This hole was formerly chipped in one and one-quarter hours. It is now cut by the Heliarc process in one minute.

• • •

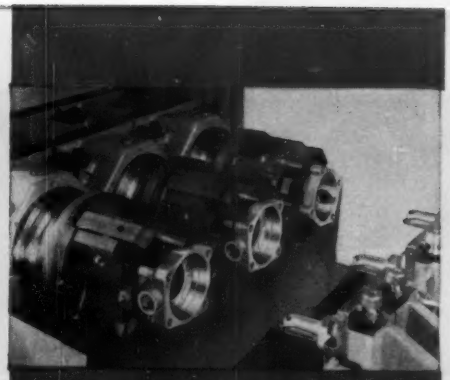
Hot Hardness Tester

Considerable savings have been gained at the chemical and metallurgical departments of the Aircraft Engine Division, Ford Motor Co., Chicago, Ill., through the development of a hot hardness testing method. Originally, it was necessary to send various alloy materials to outside testing laboratories to obtain the required data—a slow and costly process.

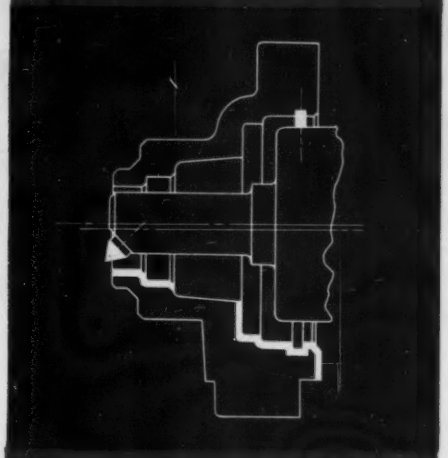
The setup for the new method consists of an electrical resistance furnace mounted on a Rockwell hardness testing machine, as seen in the accompanying illustration. Heated samples to be tested are surrounded by a protective atmosphere of inert argon gas. The arrangement can be used to determine the hardness of alloys up to 1800 degrees F.



Electrical resistance furnace supplied with protective atmosphere is mounted on Rockwell tester to determine hardness of alloys at elevated temperatures.



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



12 operations are performed at one machine cycle. Heavy lines denote surfaces machined.

Intricate contouring is fast, accurate—

12 operations in one cycle!

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

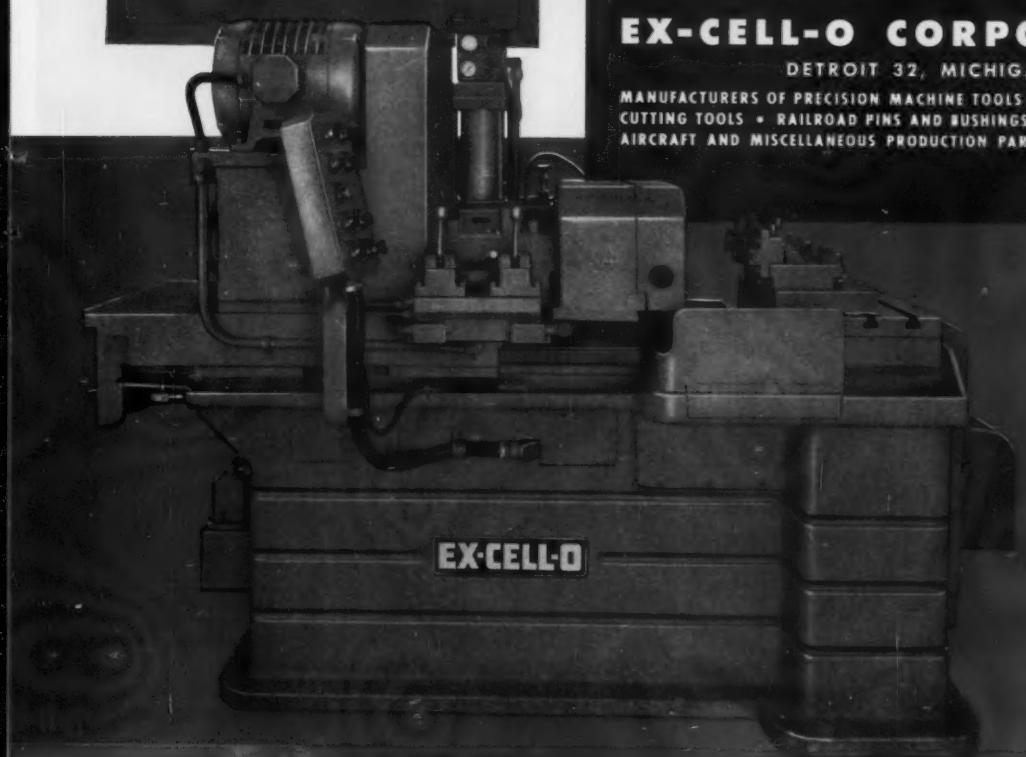
Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-52



At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.

NEW all-steel ERIE
ERIE

RIGIDROP

New design piston-lift gravity drop hammer with

New variable stroke control

More guiding surface for closer-tolerance forgings

Safety-streamlined, economical all steel construction

Experienced hammer operators will take quickly to the definite working advantages of this new Erie Rigidrop. It is a brand new concept in a simple-to-operate all-steel production hammer—striking more blows per minute, more easily, and with finer control than ever before realized. Certain shops will find this the most economical hammer they can use in their operations.

Most appreciated in Rigidrop's action is its ability to control stroke variation. This is not simply a short stroke feature, but a *new variable stroke control* allowing you to get *all the range* of strokes between the conventional short and long. Its treadle operates as simply as the accelerator on your automobile—for short fast blows, just press lightly; for longer strokes, apply more foot pressure as desired. And . . . your operator can instantly shift from short strokes to longer, and shift back again just as quickly.

There are many more features of the Rigidrop which will appeal to cost-conscious shops. We'll gladly have an experienced Erie Foundry representative call on you to explain its application—just ask.

Now available in sizes 1500 thru 5000 lbs., inclusive

40% more guiding surface—New Erie guide arrangement provides more accurate guiding of ram and continued maintenance of die adjustment.

Adjustable guides—Guide-Ram adjustments easily made from front and back of Rigidrop at close-to-floor level. Ram can be removed from the hammer at die level, without jacking.

Safety designed throughout—No loose linkage, no overhanging parts on the front of the Rigidrop. An air cushion head provides added protection if the hammer is overstroked.

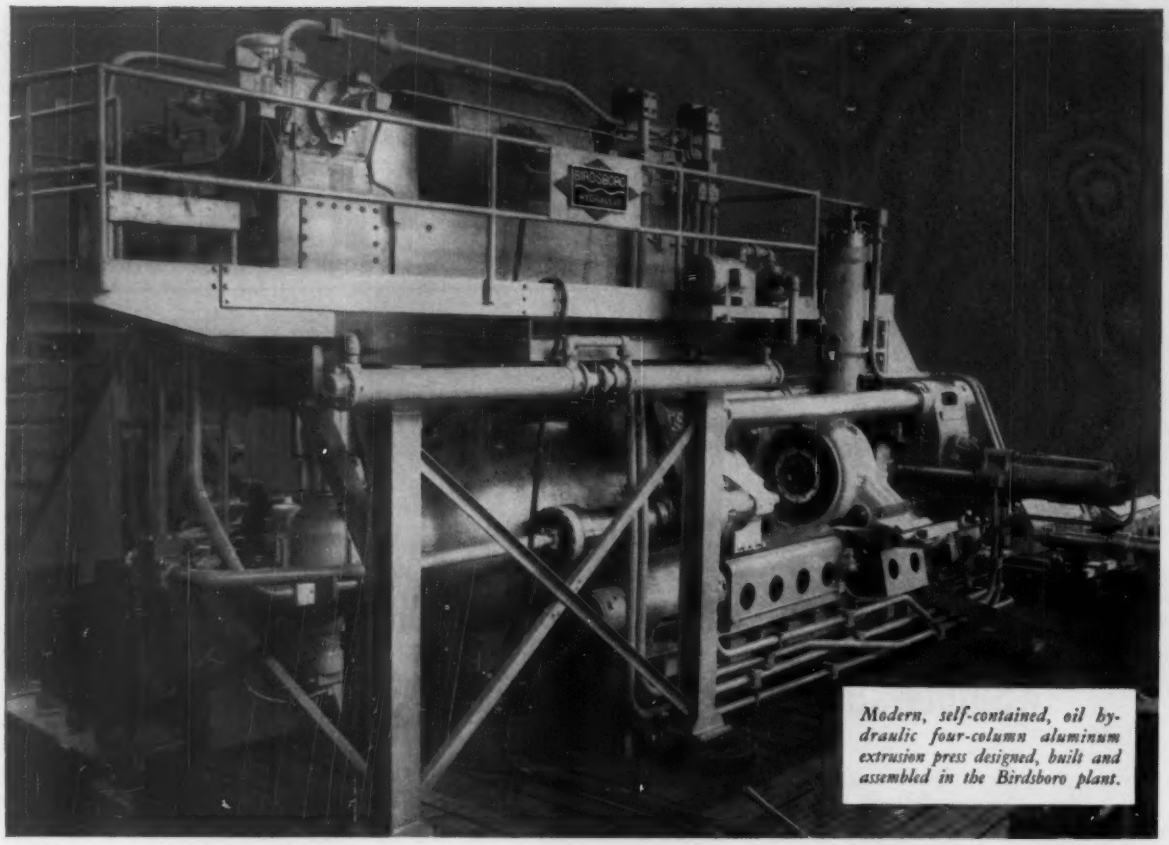
Built-in inching mechanism—For easy die setups.

Better clamping system—Clamp faces are directly opposite one another to give positive clamping action without bending the rod.

Minimum down time—Never any board replacements.

SINCE 1895—THE GREATEST NAME ERIE *IN FORGING HAMMERS*

ERIE FOUNDRY CO. ERIE, PA.



Modern, self-contained, oil hydraulic four-column aluminum extrusion press designed, built and assembled in the Birdsboro plant.

BIRDSBORO DESIGNS NEW EXTRUSION PRESS

for high speed production of intricate aluminum shapes

● Here is Birdsboro's new, modern design press . . . timed to meet today's needs for safe, rapid and efficient extrusion of billets of aluminum and its alloys.

Rated at 2750 ton capacity, the press is capable of making extrusions from billets 8″ to 12″ in diameter x 32″ maximum length. It can also be fitted to handle billets from a general rectangular container 4″ x 16″.

The press features a unique die slide which permits insertion of a die stack in either of two locations. Developed to provide high production, this feature allows extrusion to proceed through one die while a second die stack is being inserted, removed or dressed.

The hydraulic system consists of three large oilgear pumps, two constant delivery at 108 gpm and one featuring electronically controlled variable delivery at 108 gpm.

Discover for yourself how the new line of Birdsboro-designed extrusion presses can give you new shortcuts to low-cost, high-speed production of intricate aluminum shapes. Drop us a note on your company letterhead for additional information.

PHYSICAL DIMENSIONS:

Over-all length	34′6″
Height at highest point over vertical shear	14′8″
Location of Centerline from floor level when installed	3′6″
Weight when installed	380,000 lbs.

HP30-56

BIRDSBORO HYDRAULIC

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STEEL FOUNDRY AND MACHINE CO.

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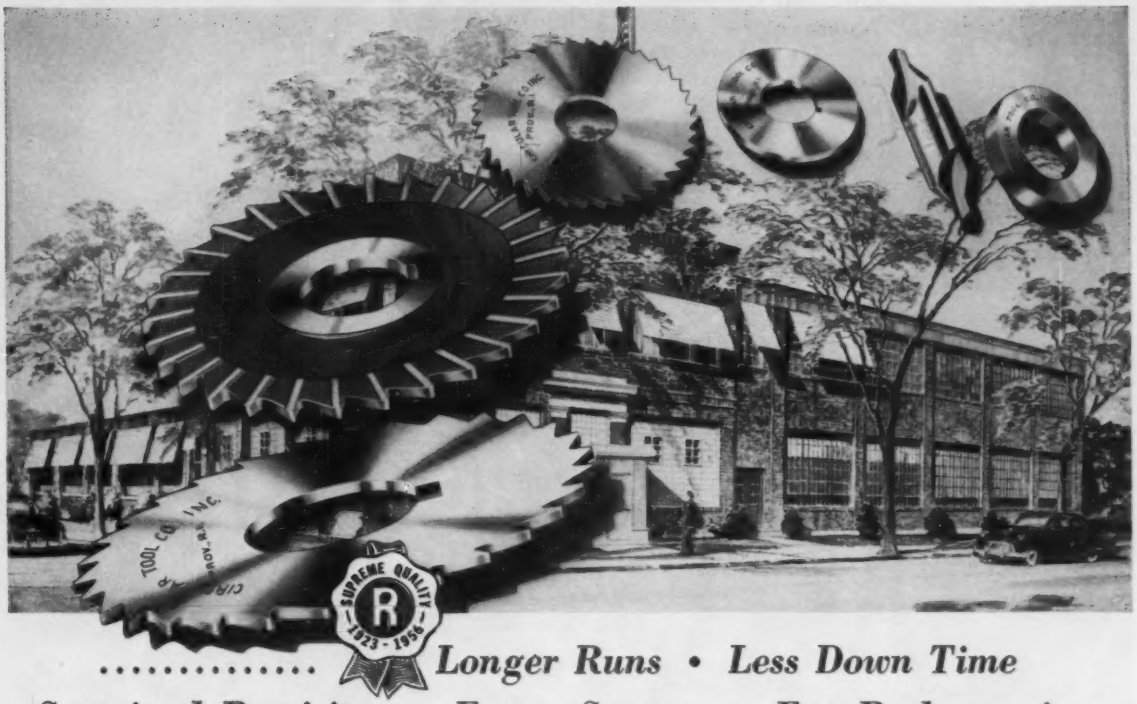
AUTOMATION ANALYSES
Rank CIRCLE R *Cutting Tools Highest in Efficiency and Economy*



Longer Runs • Less Down Time
Sustained Precision • Fewer Stoppages For Resharpening

For automation as for regular production, Circle R saws and other circular metal-cutting tools prove the best you can buy — though they cost no more.

- **CIRCLE R** Specialized Facilities comprise 45,000 square feet — devoted *exclusively* to development and production of circular metal cutting tools.
- **CIRCLE R** Quality and Cost are controlled by Magnaflux Inspection — a scientific method which for us discards rejects before they reach costly finishing stages, and for you eliminates much of the usual down time due to defects.
- **CIRCLE R** Representatives are specialists in metal-cutting problems — backed by Factory Consultation service which reflects continuous research and experience since 1923.
- **CIRCLE R** Standard Products — and specialties tailored to special needs — include the complete range of metal slitting saws, copper slitting saws, cut off saws, screw slotting saws, commutator slotting saws, jewelers' slotting saws, circular knives & rotary shear blades, Circoloy steel saws, solid & tipped tungsten carbide saws, combined drills & counter-sinks, and center reamers.

Consult these
CIRCLE R Specialists

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PROVIDENCE 5, RHODE ISLAND

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Specialists in Circular Cutting Tools Since 1923

For more information fill in page number on Inquiry Card, on page 263

Schrader 3-WAY PILOT VALVES, which respond to the out-of-phase cam-operated valves, automatically actuate unscrambling actions on conveyor. Some other Schrader Air Products involved in this operation are indicated in red (Numbers 1 through 5).

How Schrader Air Products automatically

unscramble paraffin blocks—unwatched!

Arranging bars of hardened paraffin from a disorganized pile to orderly groups of five, ready for packaging, is a cinch at one New York plant. Schrader Air Products do the job fast and accurately, unattended. Air-activated "fingers" of metal do the trick, as fast as the bars descend the incline.

Every day, new ways are discovered for performing operations automatically with Schrader Air Products. Schrader's line of industrial products includes hundreds of units which can be arranged in limitless combinations for thousands of different jobs. And air always brings to any job its basic economy, safety and efficiency.

Do *you* know the Schrader story in relation to *your* plant's needs? Learn it now, by asking for Schrader engineering assistance in planning for most efficient use of air in your plant. Outline your problems for us and we can help you select the products best suited to your applications. Or, send for the latest informative booklets which show Schrader Air Products that will help you increase production—economically.

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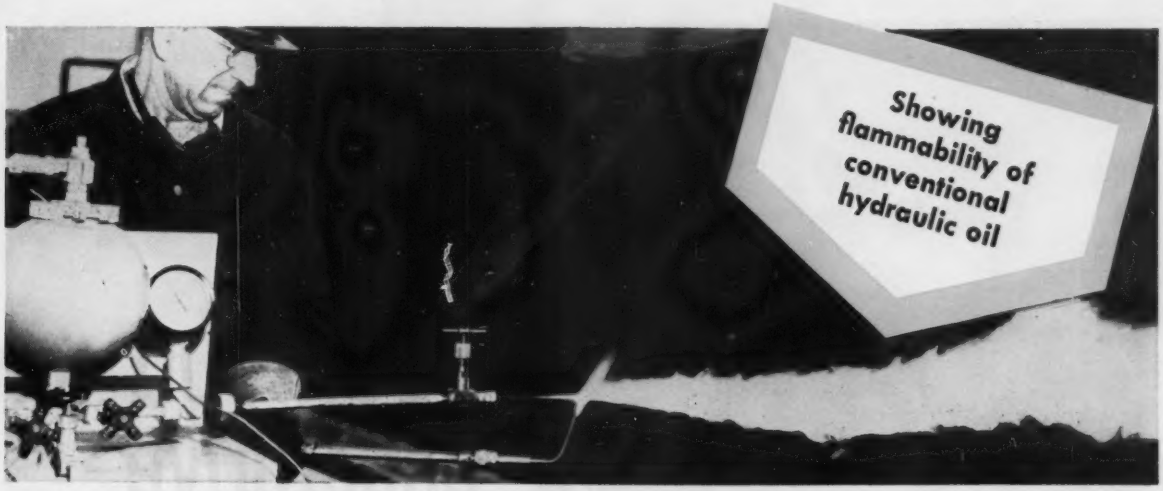
ESTABLISHED IN 1844

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
454 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL



Flame tests prove its fire-snuffing ability

SHELL IRUS FLUID 902

Entirely new formula: Shell Irus Fluid 902 is a special formulation . . . product of three years' development and field testing. It is suitable for nearly all industrial hydraulic systems, as a direct replacement for presently used oils. *Here is a fire-resistant hydraulic fluid that can be widely used.*

Non-corrosive: Shell Irus Fluid 902 contains no corrosive ingredients. It has no harmful effects on seals, fittings or bearings. It does not promote rust.

No major modification necessary . . . simply clean present fluid thoroughly out of system and replace directly with Shell Irus Fluid 902. You can use it with complete confidence. Write for test data and all information.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

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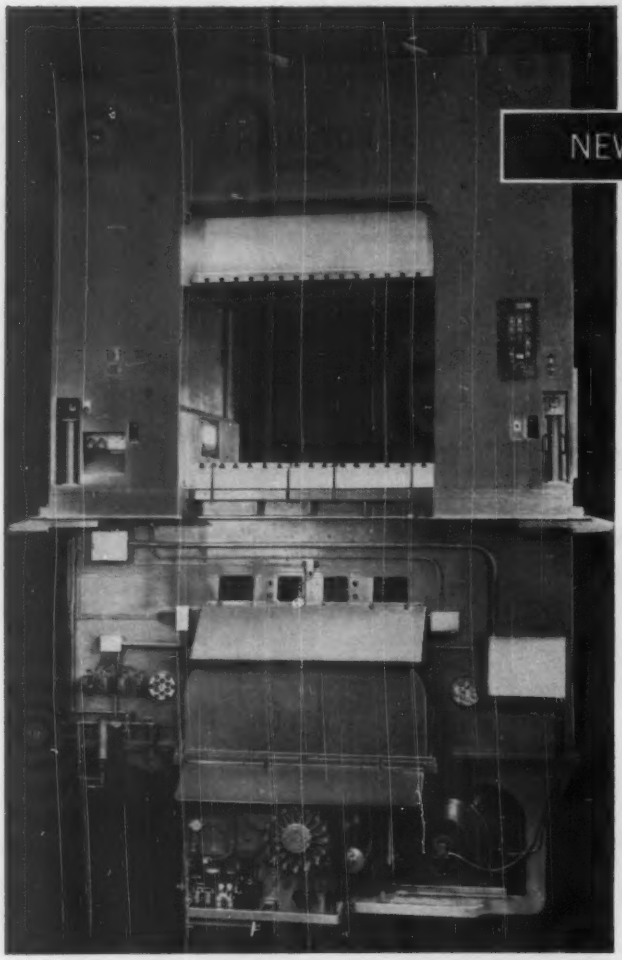


NEWS FROM HAMILTON!

New 500-4000 ton underdrive draw press "package"...

for fast easy installation...
simplified maintenance...
smooth, safe drawing...
more productive strokes
per minute

Thirty years the leader in the mechanical press field, Hamilton now gives you this latest product of dynamic press know-how. An all-new line of 500 to 4000 ton mechanical draw presses engineered for fast, safe drawing operation . . . with each press a "package unit" for quick installation, easy maintenance.

- *Package design* keeps all piping and wiring within the rugged, welded steel press structure. Installation is quick and easy.
- *Hamilton's Exclusive Double-Lube system* provides both pressure and gravity flow lubrication to all bearings.
- *Operating mechanism in the press bed* simplifies inspection and maintenance during operations.
- *Variable cycle sequences* insure more productive strokes per minute.
- *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

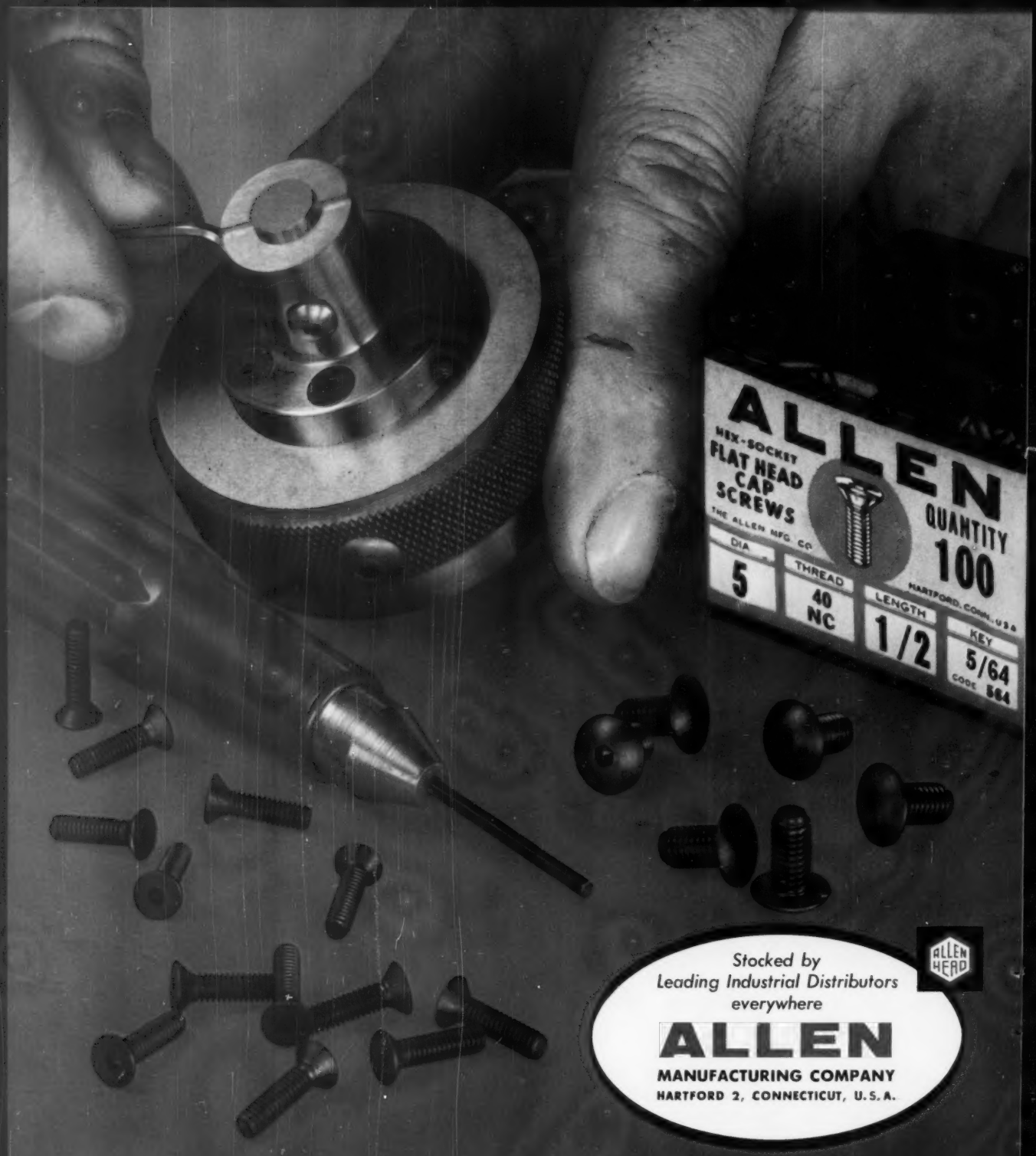
You'll speed your production while you slash installation and operating costs . . . with these new Hamilton underdrive presses in your shop. They're designed and built to handle your toughest jobs better, faster—with far less downtime. Get the full story today! Write for complete specifications to Dept. 9677, Hamilton Division, BLH Corp., Hamilton, Ohio.

BALDWIN · BLH · LIMA-HAMILTON

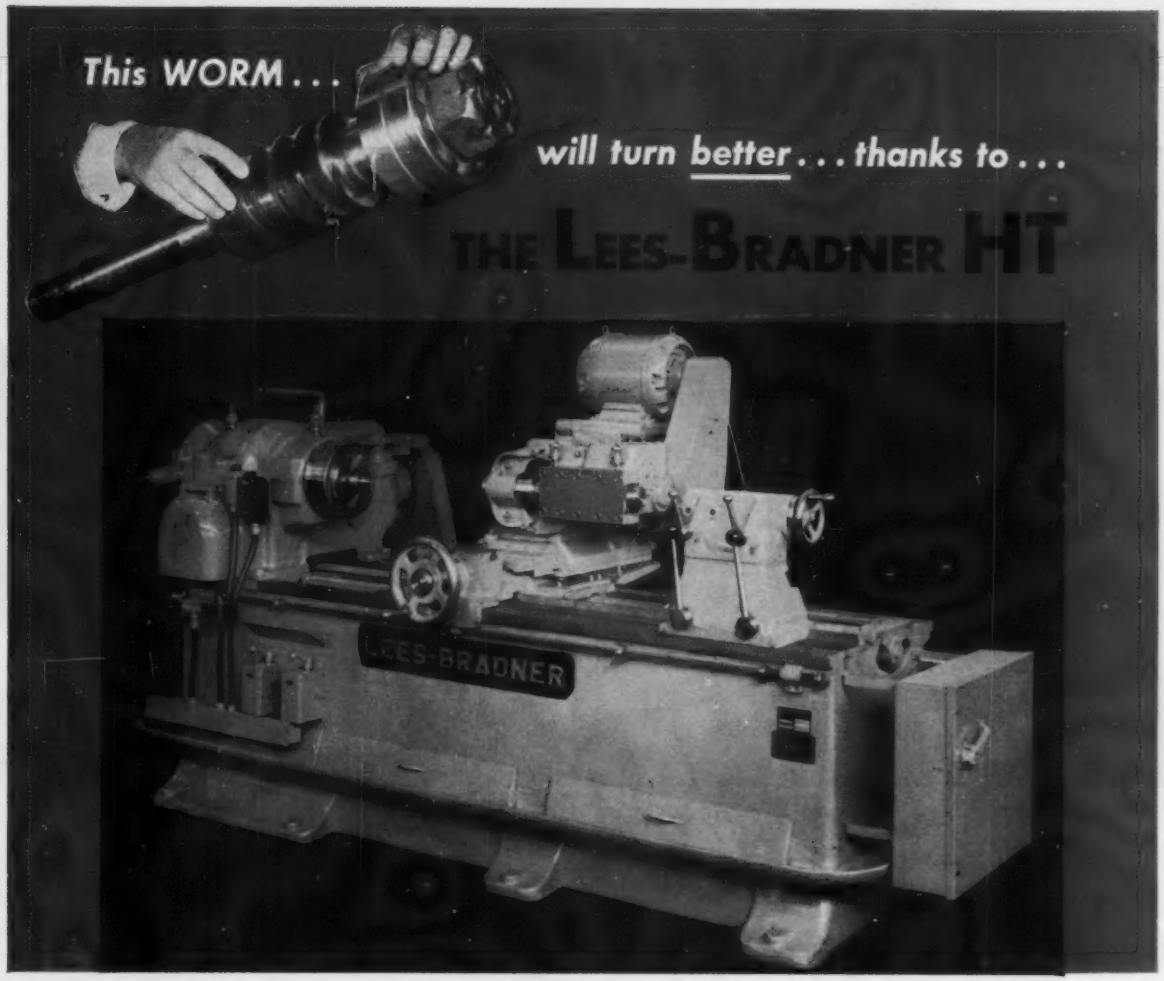
HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

For tool
and work holding
it's
Jacobs
CHUCKS
Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.
The Jacobs Manufacturing Company • West Hartford, Connecticut



Your hardest fastening jobs are just what Allen Leaderpoint Cap Screws are made for!



Building precision into other machine tools is the unique distinction that can be claimed for The Lees-Bradner Model HT Thread Milling Machine.

The worm illustrated above was produced on this machine by the Cleveland Worm and Gear Co. in one hour 23 minutes at a cutter spindle speed of 61 R. P. M. The pitch diameter of the worm was 3.728" with an outside diameter of 4.625".

Many tough thread milling problems like this have been, and are being, solved by this remarkably versatile machine.

Contact us or your local Lees-Bradner representative for complete information on fast, precision threading with the Model HT Universal Thread Milling Machine.

Details on Worm Gear Production

Hob Spindle Speed	61 R. P. M.
Circular Pitch	1.420"
Pitch Diameter	3.728"
Outside Diameter	4.625"
Threading Time	1 hour 23 min.
Material	2315 Steel
Weight of Worm	51.76 lbs.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

Why the Die Designer Prefers PRODUCTO Die Sets

He can specify Producto with complete confidence

The die designer likes to specify Producto die sets on his blueprints because they are a nationally-accepted "brand." They're easy to get anywhere... and delivery is prompt.

He favors Producto because he knows he never has to compromise his die design. Even if the die layout is a little unusual, he will be able to select a die set to accommodate it from Producto's wide range of thicknesses and styles.

He also knows Producto has the equipment that can cut his tooling costs by letting him adapt his sets to a more economical *basic* design. Only Producto offers him complete foundry, pattern-making, welding and machining services for his special requirements.

The die designer recognizes Producto's Qwik-Fit Guide Pins as an important new feature that die makers want. He specifies them because they save up to 75% of the time normally required for die set assembly and disassembly.

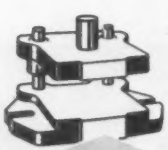
The die designer likes to use Producto's new catalog, the industry's most practical tool. His die layout is simplified when he uses Producto die set templates. And Producto provides him with cost-saving ideas in the DIE SET DIGEST.

Most important, he can depend on *consistent* Producto die set accuracy to transfer from the drawing board to the press the precision and ingenuity of his die design.

Yes, the designer has found that Producto die sets justify his confidence in specifying Producto. You will, too.

TWO FREE AIDS to more economical, efficient use of die sets are available from Producto. All-new CATALOG NO. 11 makes ordering and selection job easy. DIE SET DIGEST gives valuable tips for designers, builders and users of dies. Write for them today.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Ave., Bridgeport 1, Connecticut



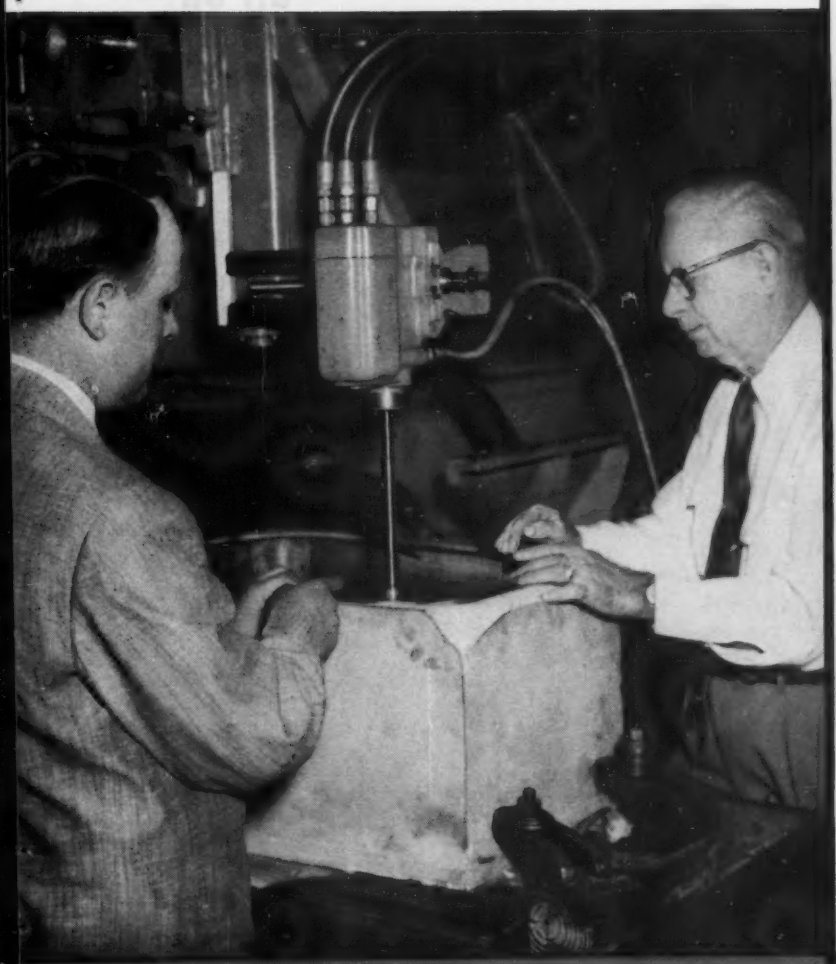
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

For more information fill in page number on Inquiry Card, on page 263

STANOIL *Industrial Oil tough performer in delicate operation*



A. T. Wallace (right), President of Wallace Tool and Die Company, and Standard Oil lubrication specialist, H. A. Peterson, check sensitivity of new Cincinnati Hydro-Tel Milling Machine which uses STANOIL as hydraulic medium. Howard Peterson has been providing technical service to customers since joining Standard Oil. He is a graduate of General Motors Institute. Howard's customers find this experience pays off *for them.*

Delicate operations with metal requiring almost a surgeon's skill are every day stuff to Wallace Tool and Die Company, Indianapolis. Recently, they purchased a Cincinnati Hydro-Tel Milling Machine for their highest precision work. They selected STANOIL Industrial Oil for the hydraulic medium. The reason for choosing STANOIL: they wanted a hydraulic fluid that could deliver high performance. They wanted a clean hydraulic system, free of deposits that might clog filters and interrupt operations. They wanted smooth operation without pump chatter and without foam. They got these with STANOIL.

How did Wallace Tool and Die come to choose STANOIL? The answer is not hard to find. They had used STANOIL for hydraulic systems throughout their plant for many years. It has given them the results they wanted so it was natural to pick STANOIL for their new Cincinnati machine.

With STANOIL the machine performs the delicate operation of contour tracing with only 3½ ounces of pressure needed to control the milling cutters. STANOIL gives them smooth, steady, uninterrupted performance.

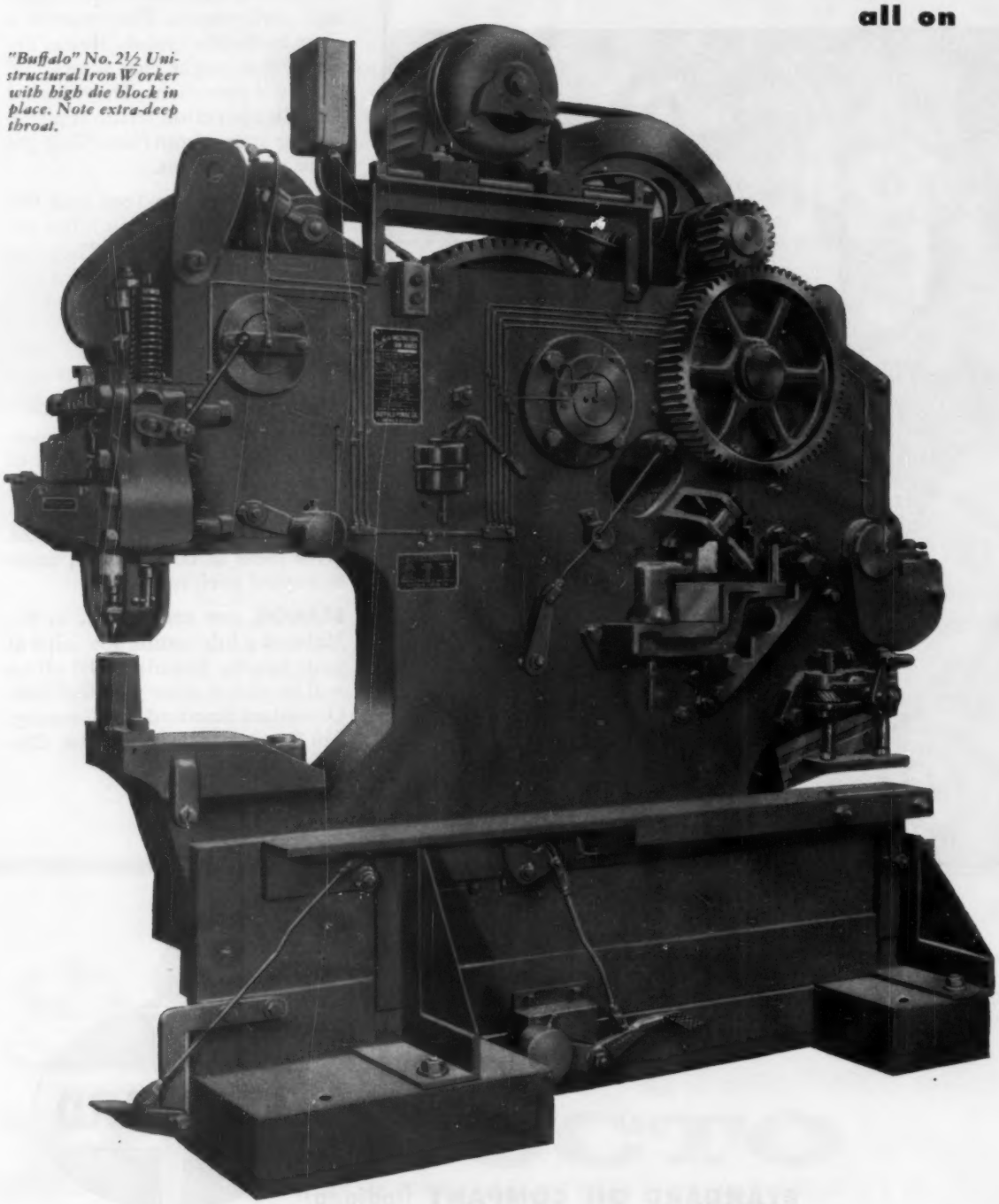
STANOIL can serve you. In the Midwest a lubrication specialist at your nearby Standard Oil office will be glad to show you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY (Indiana)

CUT •

all on



"Buffalo" No. 2½ Unistructural Iron Worker with high die block in place. Note extra-deep throat.

PUNCH • SHEAR • SLIT • NOTCH • COPE

one machine... rapidly... without changing tools

"BUFFALO" UNISTRUCTURAL IRON WORKER

These latest additions to the "Buffalo" line of Iron Workers answer the need for larger capacity steel fabrication. Punch capacity is 1-5/16" x 1" or 1-7/16" x 7/8". The bar cutter handles up to 2-1/4" rounds or 2" squares. Shear capacity is 3/4" plate thru center or 7/8" plates, trim only. The punch throat is ample — 24" deep and 20-3/4" high, and may be fitted with choice of 3 die-blocks; standard low, standard high and special. Like the smaller U.I.W. shown below, it may be had with built-in V-notcher and square coper. If you do heavy fabrication work, it will pay you to put one of these husky, multiple-job machines in your shop! Write for Bulletin 360, which gives data on "Q" Factor* "Buffalo" construction, and all capacities.

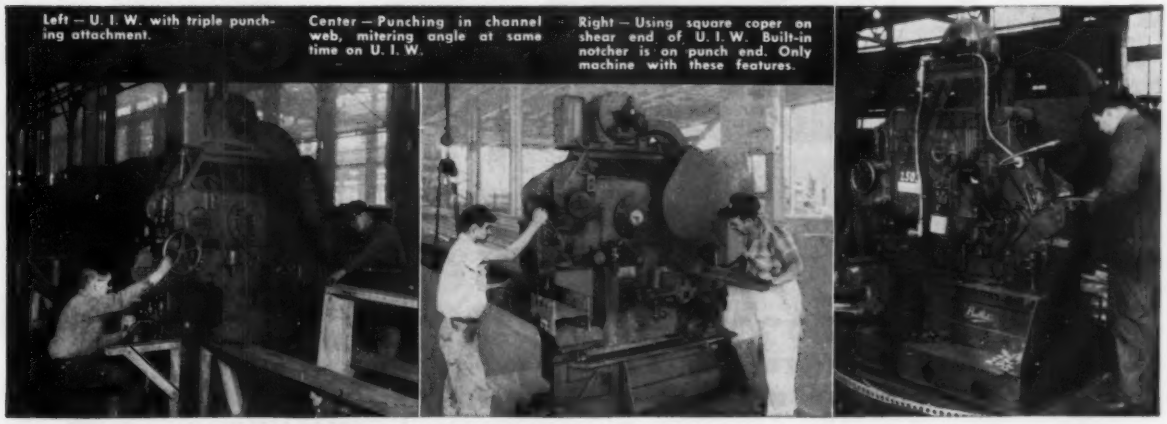
"BUFFALO" UNIVERSAL IRON WORKER

If you do two or more of the above operations, you could be cutting fabrication time and costs with a "Buffalo" U.I.W. The most versatile machine in the shop, it takes the *space* of one machine and takes the *place* of many. Three men can use it at once. You save conveying work from machine to machine. And the "Buffalo" U.I.W. has proved itself in hundreds of shops for many years. Engineered to last, it has a rugged electrically welded steel plate frame and 1-shot lubrication. Quick miter settings, ample stripper bars. Write for Bulletin 360 and see the 5 models ready to do a shop-full of work for you!

Left — U. I. W. with triple punching attachment.

Center — Punching in channel web, mitering angle at same time on U. I. W.

Right — Using square coper on shear end of U. I. W. Built-in notcher is on punch end. Only machine with these features.



*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

"Buffalo"

Product Directory

To find headings easily, look for cupital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Discs
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

I Unit...

3

Filtration Processes

- MAGNETIC SEPARATOR
- GRAVITY ATTRACTION
- FILTRATION

Delpark UP-FLO MAGNETIC SEPARATOR AND FILTER

...WITH PERMANENT FILTER SCREEN and 3 COMPLETELY AUTOMATIC CLEANING DEVICES

Combines the new Delpark powerful magnetic separator with a permanent filter media bar stock screen. Swarf bearing liquids flow on top of a large flat magnetic field. Magnetic unit incorporates more Alnico #5 magnets, gives twice the width of field, brings all swarf in suspension within the influence of the magnetic field, puts gravity to work in assisting the magnets and prevents washing and turbidity by using low velocity flow. This feature is particularly desirable on high viscosity fluids.

Three cleaning devices, completely automatic, remove the separated residue from the unit. Chain driven flights remove deposits from the magnetic field and the bar stock screen. .004" bar screen is cleaned by an air shaker device to dislodge enmeshed particles. A drag-out unit is built into the clean coolant tank.

Up-Flo Filters are available without magnetics for non-ferrous metal applications.

See your Delpark representative for more complete information or write.

Delpark FIRST IN FILTRATION ADVANCEMENTS

INDUSTRIAL FILTRATION COMPANY LEBANON, INDIANA

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts. Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Ajax Electric Co., Frankford at Delaware, Philadelphia 23, Pa.
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 290)

Crane acking ompany

FLAT LAPPING SERVICE

NEW High Production Flat Lapping Facilities

Lapmaster® DIVISION CRANE PACKING COMPANY
6400 Oakton Street, Morton Grove, Ill.

Need parts finished to precision flatness?

Read this folder

If you're looking for someone to produce precision flatness on your parts, our flat lapping service department is equipped to produce parts with a flatness of .000011 inch or less and finishes to 2 micro inches on a wide range of sizes in large or small production runs. Materials range from steel, Stellite, cast iron, brass and aluminum to plastics, glass, ceramics, carbons and many others.

Thirty-six machines, together with "know how" and precision inspection facilities, insure work to meet your requirements. Branch service plants are also located in Houston, Los Angeles, Miami, New York, Philadelphia and Hamilton, Ontario.

For complete information, write for this free folder today.

CRANE PACKING CO.
6433 Oakton St., Morton Grove, Ill. (Chicago Suburb)

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Lapmaster® DIVISION

CRANE PACKING COMPANY

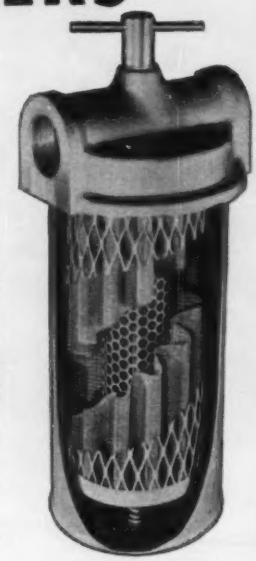
38 YEARS INDUSTRIAL PROGRESS

For more information fill in page number on Inquiry Card, on page 263

Simplify Preventive Maintenance on Hydraulic Equipment with MARVEL SYNCLINAL FILTERS

SUMP TYPE (cutaway)

Change excessive and costly "DOWN-TIME" to Profitable "OPERATING TIME"



LINE TYPE (cutaway)

Any workman can easily disassemble, thoroughly clean and reassemble MARVEL Synclinal FILTERS, on the spot, in a matter of minutes. RESULT:—The equivalent of a brand new filter, ready for longer periods of dependable service and protection.
MARVEL Synclinal FILTERS are "permanent type" filters because there are no throw-away parts to buy or replace, no moving parts to wear out or break down. Your FIRST COST is your ONLY COST.
Marvel's BALANCED Synclinal design offers 2½ times more ACTIVE filtering area with sufficient storage capacity for filtered-out damaging particles; thus, longer periods of productive operation are attained at a minimum filter maintenance "down-time."
You can further simplify your preventive maintenance program by standardizing with MARVEL Synclinal FILTERS, by specifying them on all new equipment and installing them on existing equipment.

FOR EFFICIENT FILTRATION of Hydraulic Oils, Fire-resistant fluids, Coolants, Lubricants, Water—
and
FOR DEPENDABLE PROTECTION on all Hydraulic and other Low Pressure Circulating Systems—
investigate MARVEL SYNCLINAL FILTERS

OVER 700 Original Equipment Manufacturers install MARVEL SYNCLINAL FILTERS as Standard Equipment!

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

Immediate Delivery
As in the past, Marvel continues to offer IMMEDIATE DELIVERY!

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY
7227 N. Hamlin Ave., Chicago 45, Ill. PHONE: JUniper 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows:—
- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name .....
Company .....
Address .....
City .....
State .....

MY-10

ARC WELDERS—See Welding Equipment, Arc

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT
American Crucible Products Co., Lorain, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES
Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

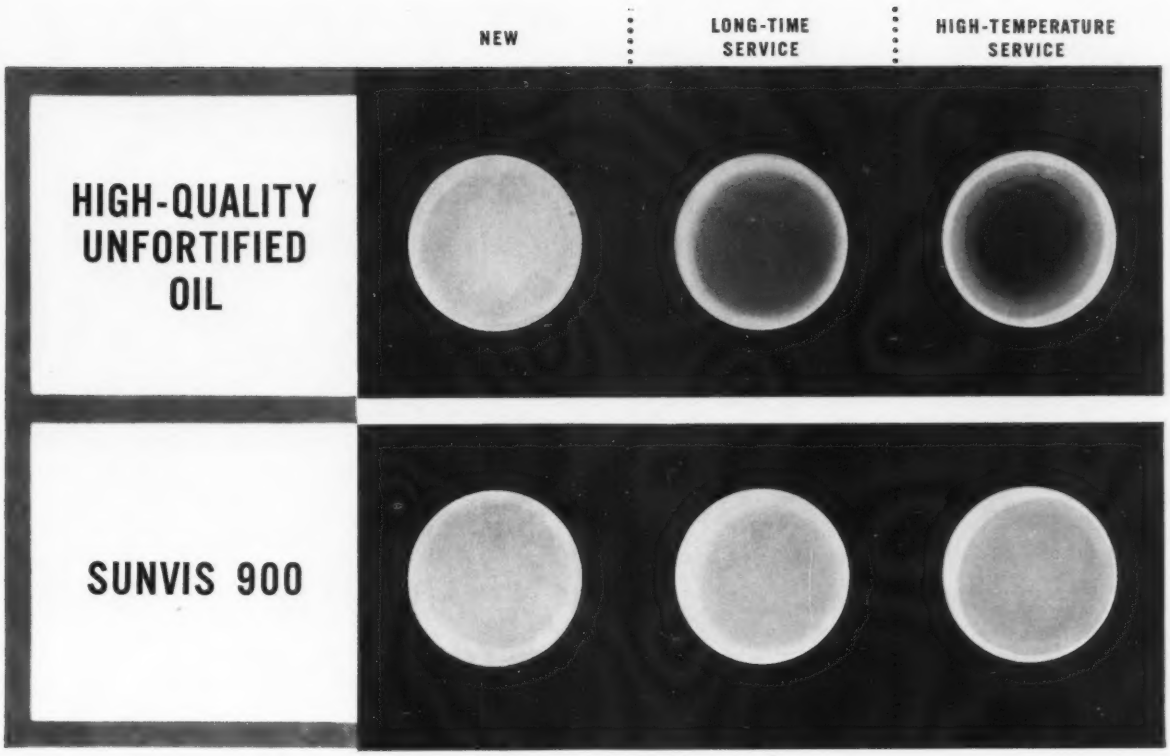
BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BARS, Steel
Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BEARING PILLOW BLOCKS AND CARTRIDGES
Fafnir Bearing Co., New Britain, Conn.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

(*Continued on page* 292)



Oil color tests show

WHY SUNVIS 900 OILS SAVE YOU MONEY IN CIRCULATING AND HYDRAULIC SYSTEMS

Color means very little in brand new oils. But...color *change* during service can mean a lot. While minor darkening is seldom serious, radical color changes indicate danger, except, perhaps, in a highly detergent oil.

Either the oil is contaminated by foreign matter, or as in the pictures, the oil has oxidized from heat and long use. The products of oxidation darken the color of ordinary oils...clog valves and filters, cause excessive maintenance.

Compare the appearance of the used Sunvis 900 with the appearance of the other used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

Here's proof that Sunvis 900 oils will last longer and provide the extra needed resistance against the high temperature "hot-spots" of typical hydraulic and circulating systems. *For the long run, a Sunvis 900 oil is the most economical oil you can buy.*

For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-31.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

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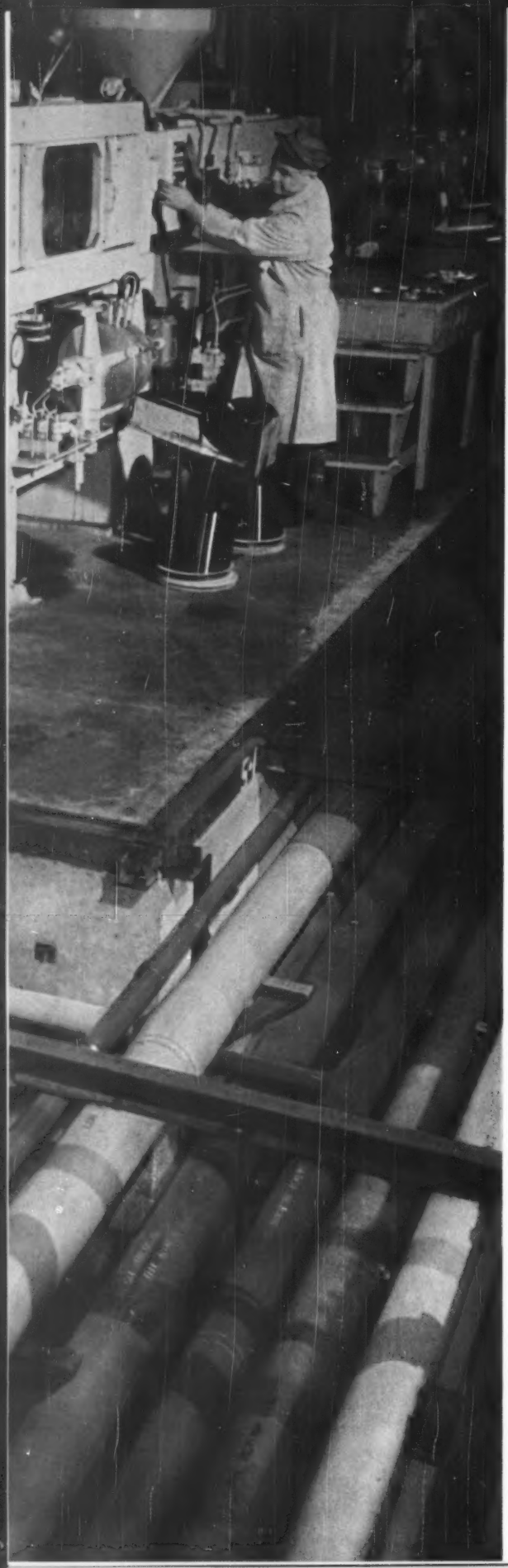
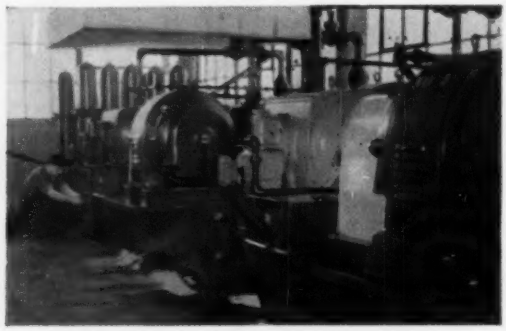
In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO



High-Pressure Pumps, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

This is just part of the story about Sunvis 900 oils. Why not talk them over with your Sun representative the next time he calls. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-32.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

© SUN OIL CO.

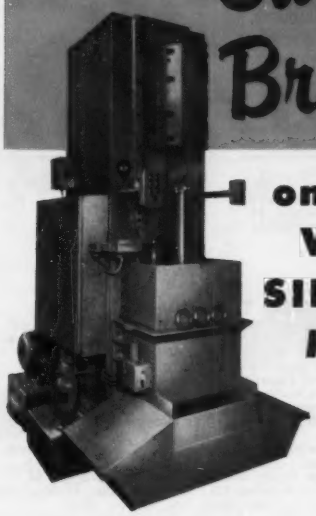
Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal

UNUSUAL TOOLING SETUP FOR

External Surface Broaching

on DETROIT VERTICAL SINGLE RAM MACHINE



This broaching job requires rigidity and perfect alignment . . . which makes it a "natural" for the massive Detroit Vertical, built and tooled by experts. Note the safety feature which prevents the main slide from descending until dual push buttons have been operated. This slide holds the heavy, pot-type broach holder in perfect alignment with the fixture post, which is mounted on a fixed knee for even greater accuracy.

Detroit Vertical Single Ram machines are available in standard capacities from 5 to 25 tons, stroke length from 30″ to 90″. Interchangeable knees with shuttle table mechanism can readily convert this machine into a standard for future production needs. Oversize platens on all standard models allow multiple as well as single station tooling.

Detroit builds every size and type of broaching machine, automates and tools them to fit your needs. Call in a Detroit field engineer, or send us details of your production problem . . . today.

PART—Automotive transmission component.

OPERATION—Broach 4 external lugs, equally spaced.

TOOLING—Pot-type broach holder, built in sections for convenient tool assembly . . . in perfect alignment with fixture post.

CYCLE—Operator loads work over fixture on top of post, starts machine. Broach holder descends with ram and bottoms after cutting stroke. Operator unloads work and presses palm button for return stroke.

PRODUCTION—120 parts per hour.

MACHINE—Detroit 10-ton Vertical Single Ram Broaching Machine with 42″ stroke and fixed knee.

Write for new free bulletin on Detroit Vertical Single Ram Machine

DETROIT BROACH & MACHINE COMPANY

DEPARTMENT B-10
ROCHESTER, MICHIGAN

For more information fill in page number on Inquiry Card, on page 263

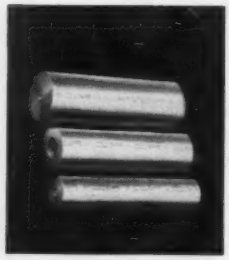
A

new freedom

IN THE USE OF BEARINGS

"Bunting Bearings" means fine bearings to machinery manufacturers, engineers and mechanical maintenance men. Bunting Cast Bronze is the outstanding metal in the field of general purpose bearing applications. Now the same high standards of manufacturing and distribution are available in a standardized line of Bunting stock sintered powdered plain and flange bearings, thrust bearings and bars.

You can choose the Bunting Bearing that exactly meets your needs. Bunting Stock Cast Bronze Bearings and Bars are available in many hundreds of sizes for all mechanical requirements. Bunting stock sintered powdered self-lubricating Bearings are available in a far greater range of standard sizes than ever before. Each embodies traditional Bunting quality.



BOTH Bunting Cast Bronze and Bunting oil filled, self-lubricating sintered powdered Bronze Bearings and Bars are available to you through your nearest Bunting Distributor. He has in stock all sizes for your immediate needs. Ask him or write for complete lists and dimensional data on Bunting Cast Bronze and Bunting Sintered Bronze Bearings.

Bunting®

BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

The Bunting Brass and Bronze Company, Toledo 1, Ohio

Branches in Principal Cities • Distributors Everywhere

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless
American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenless Bros. & Co., 2136—12th St., Rockford, Ill.

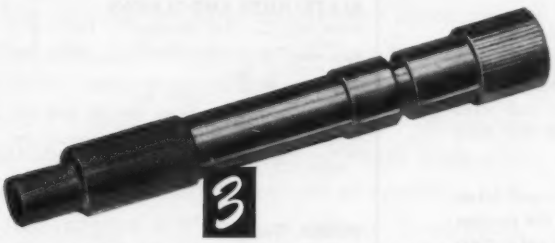
BENDERS, Plate, Etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

(*Continued on page* 294)

7 WAYS to SAVE MONEY with TOCCO* Induction Hardening

Cost was reduced 94% when heat-treatment of this corn-harvester part was changed from carburizing to TOCCO-hardening, 9½c saved on every piece — $4750 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour.

Leading automotive companies need and use TOCCO hardened axle shafts to handle higher horsepower. Better, yet cheaper—savings of $375.00 per day. Less machining costs, lower priced material, increased production, and a plus in quality—200% greater torsional life.



Kearney & Trecker Corp. reduced the cost of hardening this milling machine part from $1.57 to 10c apiece. In addition TOCCO made possible a switch from alloy to S.A.E. 1045 steel—saving another 11c per piece in material cost. Kearney & Trecker hardens 140 different parts on one TOCCO unit.

See Us At Booth 2212

National Metals Exposition—Cleveland—October 8-12

THE OHIO CRANKSHAFT COMPANY

Thompson Products Ltd. boosted production of these automotive wrist pins from 500 to 1200 per hour when they switched to TOCCO-hardening. Costs fell from $5.45 to $3.25 per hundred parts—a savings of 2c per pin, $26.40 per production hour.

Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO also upped production from 35 to 112 parts per hour—over three times as fast as conventional heating methods.

Lima-Hamilton Corporation adopted TOCCO for hardening this shifting lever. Results: a savings of 4c per piece—$25 per production hour. TOCCO costs only 17% of former heating method. This is only 1 of 139 parts TOCCO-hardened by Lima-Hamilton Corp. All show savings over usual heating methods.

Number 7—the lucky number—is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for similar cost-saving results—without obligation, of course.

*Trade Mark Reg. U.S. Pat. Off.

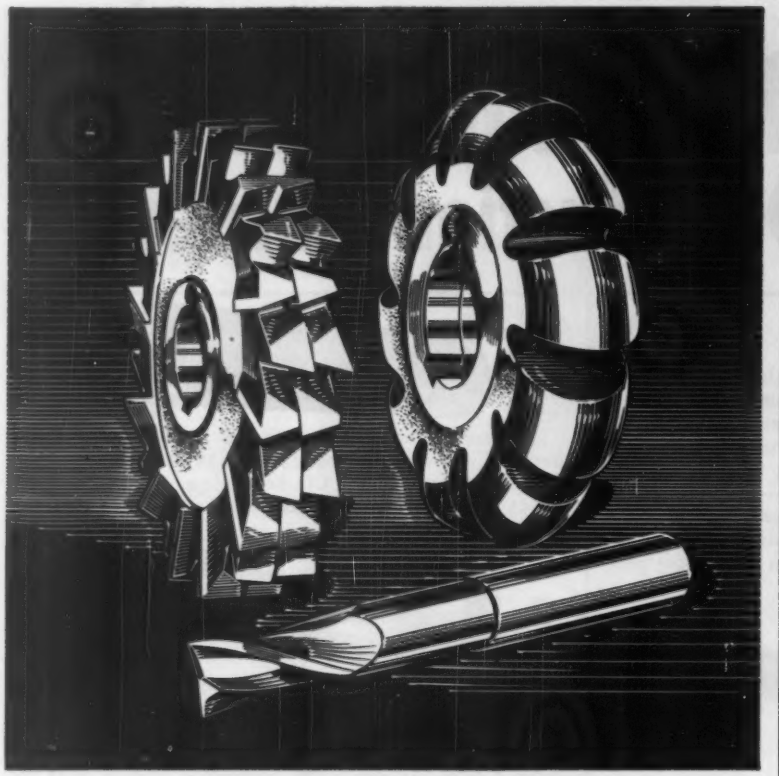
Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-10, Cleveland 1, Ohio
Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____
Position_____
Company_____
Address_____
City_____ Zone____ State_____

For more information fill in page number on Inquiry Card, on page 263



Are solid high-speed steel milling cutters obsolete?

If they are someone ought to tell our customers about it. They've asked us to produce so many styles and sizes that we finally went all the way and stock the most complete line available anywhere.

No, the solid high-speed steel cutters haven't been obsoleted by the carbides. When it comes to the smaller production runs and toolroom use, the solid steel cutters are *it*. Here, they'll perform more than adequately at the lowest possible initial tool cost. And they're much easier to maintain than the more costly carbide cutters.

Even though Go & Go produces a lot of inserted blade cutters, we're just as proud of our extensive line of solid high-speed steel cutters. Every tool is engineered with the same care and over 38 years of milling cutter know-how goes into each and every one.

Want to see the extensive stock of standards available? Ask for Catalog F, it's free on request. Go & Go also designs and manufactures special milling cutters in quantity. Check one of our engineering sales representatives in principal industrial centers for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

BENDING MACHINES, Hydraulic
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Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Pipe
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Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS
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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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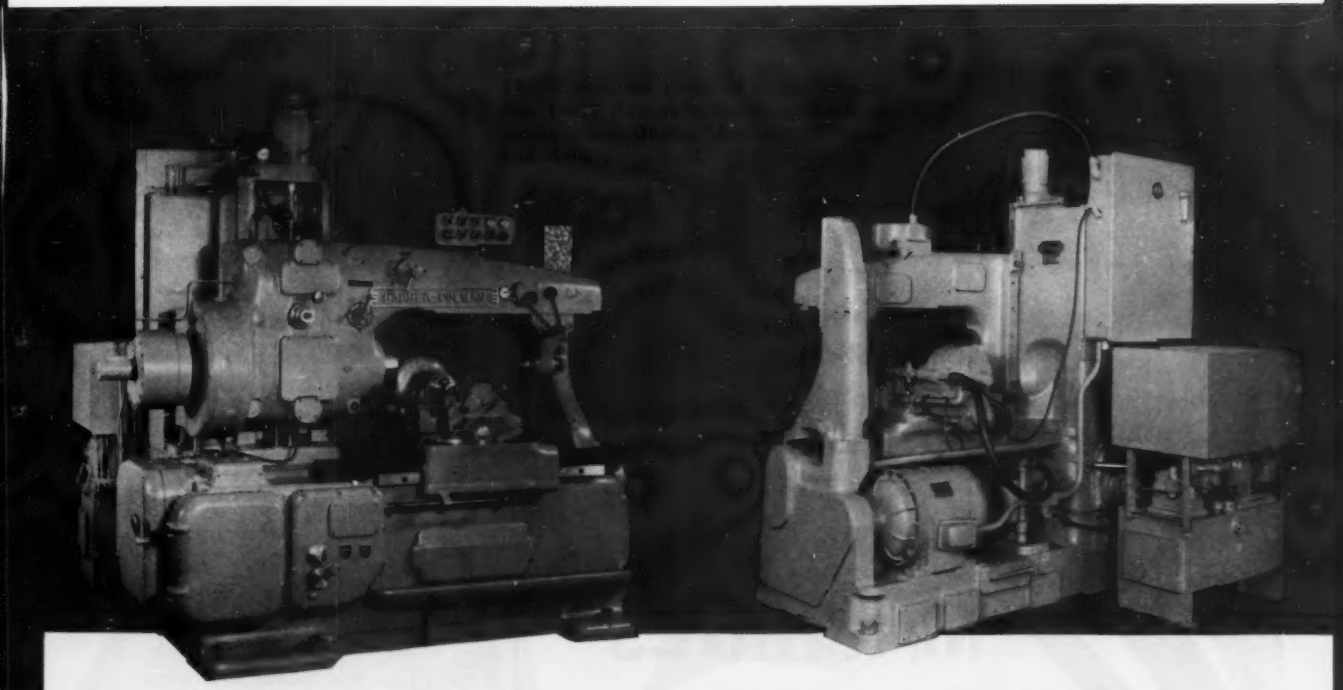
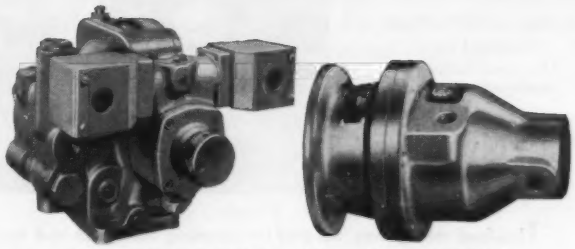


ANOTHER TRIUMPH IN MACHINE DESIGN THAT USES OILGEAR "ANY-SPEED" DRIVE FEEDS

Barber-Colman's new high-speed hobbing machine may be totally different from the machines you build. But the machine design problems they encountered in developing this machine could very well be your problems. Among the problems encountered was that of feed. To solve this problem, Barber-Colman selected Oilgear Fluid Power Feeds. These feeds give them the infinitely variable output to provide a hobbing feed range of .020″ to 1″ per minute. In addition, they provide a far more constant hobbing feed despite changes in load or system temperatures. They also provide cushioned, positive, precise, fast-acting electro-hydraulic control of feed, rapid traverse, and stop through automatic switches. Finally, they provide power for operating ten auxiliary cylinders and three valves. One Oilgear type AX-311 Pump supplies fluid power for the entire machine.

You have much to gain if you stop a moment and ask: "Why are leading machine and machine tool builders turning to Oilgear? Am *I* missing an opportunity to improve machine performance?" Why don't you compare your machine needs with what Oilgear "ANY-SPEED" Drives and Feeds can provide? You can rest assured that we will recommend our product only when it is to your advantage. Tell us your needs. We'll give you a specific appraisal of the possibilities. Write now. THE OILGEAR COMPANY, 1569 W. Pierce Street, Milwaukee 4, Wisconsin.



Type AX-311 PUMP and Type H-311 MOTOR
OILGEAR "ANY-SPEED" DRIVE FEED

OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

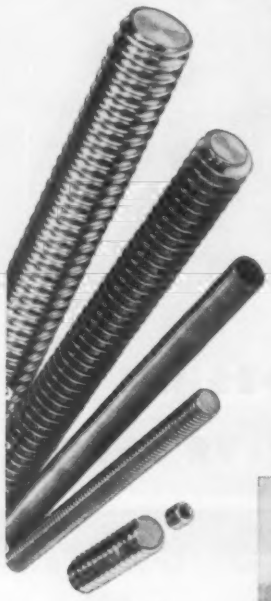
PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS & VALVES

REED ROLLED THREAD DIE CO.

Thru-feed Thread Rolling

for Continuous Precision Threading of Long or Short Bars and Tubing and Short Headless Parts

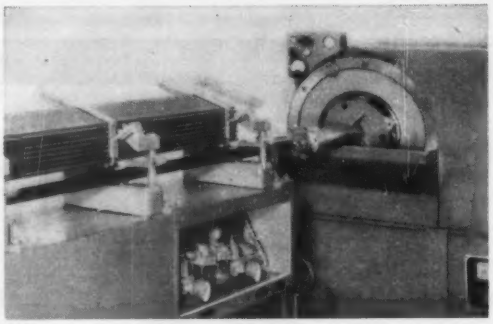
DIAMETER CAPACITIES—¼" to 3"



Hollow and Solid Parts Threaded by Thru-feed Rolling

REED MACHINES

Provide Uniform Pitch Diameter and Accurate Thread Form Over the Entire Length of the Threads



Thru-feed rolling may be used for threading both solid and hollow pieces of varying lengths and materials. Various forms may be rolled, including worms and Acme threads. Headless pieces, with threads running the entire length, may be threaded in bar lengths and then cut up into desired finished lengths.

Machines may be arranged for both manual and completely automatic loading and unloading of the parts . . . the rolling cycle with either method of loading is fully automatic. The work blank is rolled between cylindrical dies and is finally discharged at the rear of the machine. Short, headless pieces may be loaded into a chute and automatically fed, rolled and discharged. Controls are available that permit rolling the entire length, ends or middle section of a part.

Reed thread rolling machines are made in 2 die horizontal and 3 die horizontal and vertical types for thru-feed and in-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Operating handbooks are available so the tool engineer and operator can set up his own applications.

Write for Thread and Form Rolling Bulletin 199

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Michigan Drill Head Co., Van Dyck, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

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American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

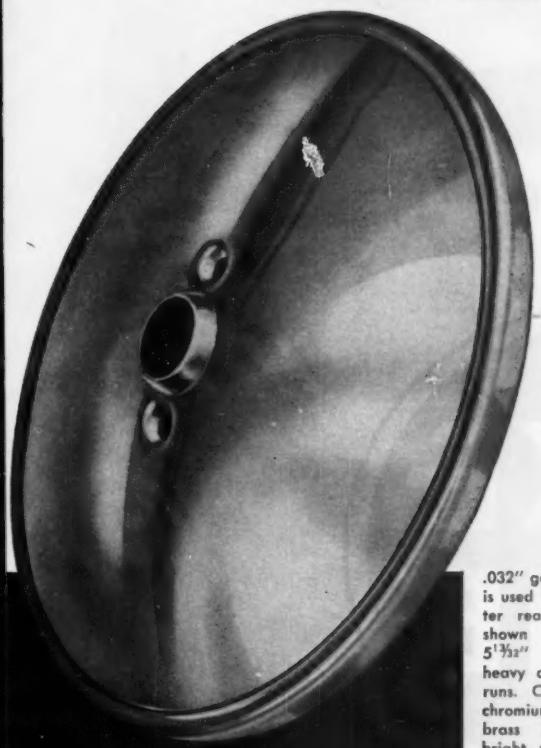
BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
New Britain Mch. Co., New Britain, Conn.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

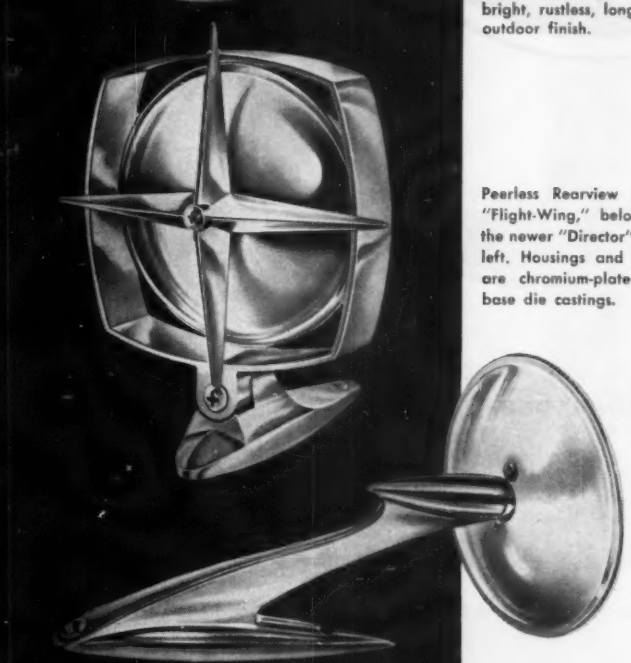
(Continued on page 298)

Bob Rossi, Chief Engineer, tells
Roy Johnson, Plant Manager

"We switched to Formbrite —and saved 12 cents apiece!"



.032" gage 70-30 Formbrite is used for this 4½" diameter rearview mirror head shown full size. Strip is 5 1/32" wide supplied in heavy coils for long press runs. Copper, nickel and chromium plating on a solid brass base provides a bright, rustless, long-lasting outdoor finish.



Peerless Rearview Mirrors. "Flight-Wing," below, and the newer "Director" model, left. Housings and mounts are chromium-plated zinc-base die castings.

This easy-to-polish, superfine-grain drawing brass has been slashing finishing costs in plant after plant, on all kinds of jobs. Now Peerless Accessories Co., of Mount Holly, N. J., reports:

"To our line of lighting and safety automotive accessories, we've recently added two rearview mirror assemblies. We had been using regular drawing brass for the dished head until your representative persuaded us to try Formbrite. Here are the results, based on a very careful cost study:

Finishing procedure using regular drawing brass	Present procedure using Formbrite®
1) Grease grinding or "cutting"	Not necessary with Formbrite
2) Buffing	Light buff
3) Copper strike	Copper strike
4) Nickel plate (.00045")	Bright nickel plate (.0003")*
5) Buffing nickel	Not necessary
6) Chromium plate	Chromium plate
Cost 27¢ each	**Cost 15¢ each**

"That's a saving of 12 cents apiece. Multiply it by 3,000 to 4,000 a day and it becomes important money!"

*Formbrite's superfine grain made possible a lighter but equally serviceable plate of bright nickel

Surprisingly, Formbrite doesn't cost a penny more. Find out for yourself how its superfine grain, excellent drawing properties, strength, and scratch resistance can help you make a better product at lower cost. Write for Publication B-39. Better yet, ask us about a sample lot. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5070

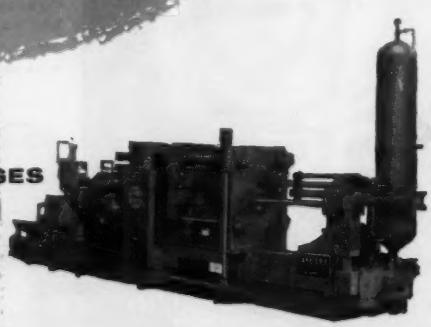
Formbrite FINE-GRAIN DRAWING BRASS

an ANACONDA® product
made by The American Brass Company

The sign of **QUALITY** in Die Casting Machines

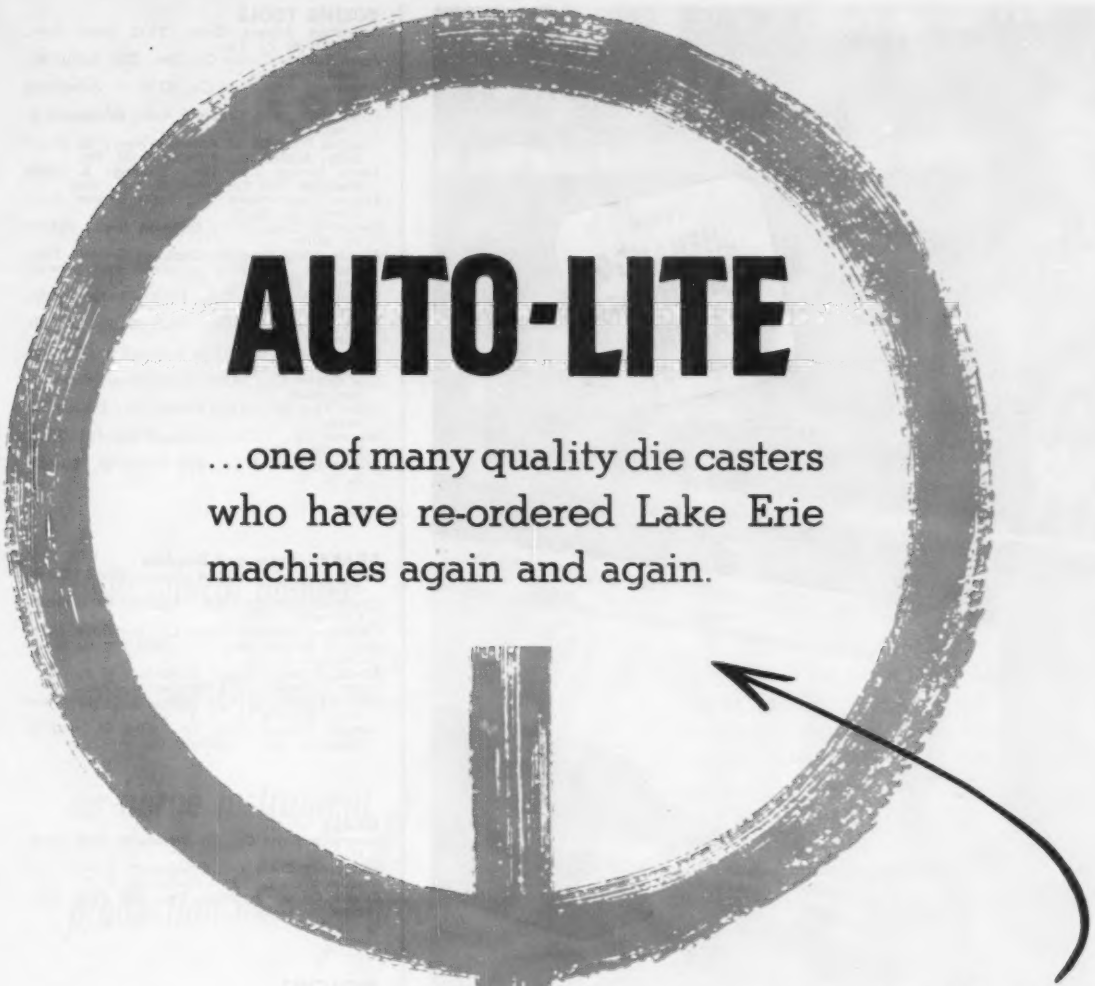
LAKE ERIE

HOT AND COLD CHAMBER MODELS IN ALL TONNAGES



AUTO-LITE

...one of many quality die casters who have re-ordered Lake Erie machines again and again.



The sign of **QUALITY** die castings produced on 83 Lake Erie machines

"The (Continental) Mark II's grille is made by The Electric Auto-Lite Company, Toledo, Ohio. Ford engineers picked this company because it could maintain the quality standards they were seeking."

STEEL Magazine—May 28, 1956

LAKE ERIE®

LAKE ERIE ENGINEERING CORPORATION, 470 Woodward Ave., Buffalo 17, New York

For more information fill in page number on Inquiry Card, on page 263

STRETCH ROLLS THAT STRETCH DOLLARS... for manufacturers of paper-making machinery. They're centrifugally cast by Shenango to provide complete uniformity, pressure-dense grain, freedom from blow holes, sand inclusions and other hidden defects. They'll wear longer, take abnormal stresses, loads and speeds without the risk of costly failure. If you need virtually any symmetrical part, ferrous or non-ferrous, large or small, rough or finished, write to: Centrifugally Cast Products Division, The Shenango Furnace Company, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS
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Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

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American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal
American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.

(*Continued on page* 288)

How optical gaging helps get Giannini air-borne instrument production off the ground faster.

In the fight for flight that's higher, farther, faster—plane and missile makers want everything smaller, lighter, tighter. Tighter means tolerances today of 0.0002″ to 0.0003″ compared to 0.003″ to 0.004″ a few years ago. That's why more and more manufacturers like aircraft and missile instrument and control maker G. M. Giannini & Co., Inc., Pasadena, Calif., are using Kodak Contour Projectors.

A pulley in one Giannini instrument is less than pencil eraser size, has groove dimension tolerance falling between 0.010″ and 0.011″, four separate angles to check out within 0.30°, a shaft diameter of plus or minus 0.0001″ or 0.0002″. Perpendicularity must be within 0.0003″. Like many aircraft parts, it's made of aluminum alloy.

Before Giannini put a Kodak Contour Projector to work on receiving inspection, getting prototypes of instruments filled with parts like this—and even tighter—used to be a mammoth problem. An undetected off-tolerance part in the master could hold up production or even throw production models out of kilter.

At Giannini, inspectors check incoming parts quickly and accurately with optical gaging, make sure they're right for the prototype. They optically check angles, shoulders, radii, positions, and all critical surfaces on a single projector. Now there's less chance than ever that production parts will be off tolerance once the master has been approved.

If inspecting small parts to tiny tolerances is a large problem with you, you should investigate optical gaging with a Kodak Contour Projector. A Kodak Contour Projector can work production and quality control miracles where control of measurements makes a better product.

Write for your copy of "Projection Gaging with Kodak Contour Projectors." Even better, ask for the name of your nearest representative, so he can personally explain projection gaging's scope and capabilities.

Inspectors quickly learn optical gaging, because it's simply a matter of looking and comparing. Perhaps you can greatly improve Toolroom, Receiving, Production, and Final inspection with a single unit. There are six models to choose from.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADEMARK

For more information fill in page number on Inquiry Card, on page 263

McCROSKY

3/8" - 7/16" - 1/2" and 5/8"

THIN SLOTTING CUTTERS

4" — 5" — 6" — 8" — 10" and 12" in diameter

with Jack-Lock® Blade Locking Wedges

• Designed specially for milling thin slots accurately and efficiently. Jack-Lock wedges extend the full width of the body. Consequently, locking pressure is applied parallel to the sides of the body, assuring true running at all times. Cutting faces of the blades are milled and ground to provide the axial rakes required. Easily converted to a half-side mill by simply inserting blades all of one hand. Extra large hubs provide added ruggedness and rigidity. Easily mounted on a grinding arbor for resharpening. Unsurpassed performance. Write for a bulletin today!

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Gentlemen:
Please send Bulletins describing the tools checked below.

☐ *Jack-Lock®* MILLING CUTTERS
☐ *Block-Type* BORING BARS
☐ *Super® Adjustable* REAMERS
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☐ *Wizard®* QUICK-CHANGE CHUCKS
☐ *Specially Engineered* MULTIPLE PRODUCTION TOOLS

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Company_____

Address_____

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Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE
American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

BURNISHING MACHINES
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
American Crucible Products Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Termaphrodite, etc. —See Layout and Drafting Tools; Machinists' Small Tools

CALIPERS, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

(Continued on page 304)

KOPING

17⅛" SWING

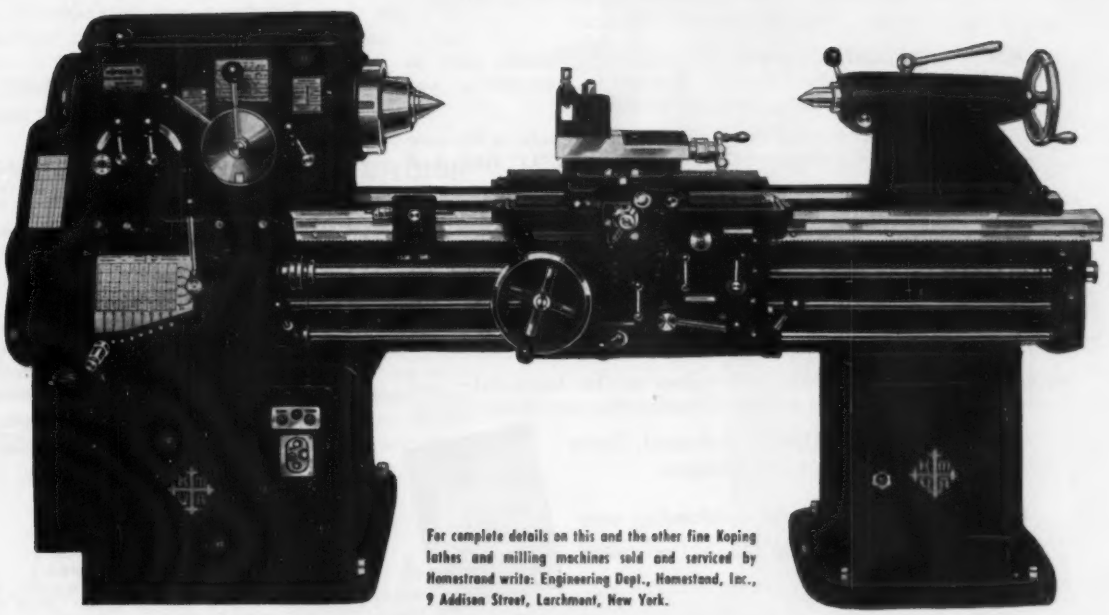
S 8 B

Designed to meet today's demands for greater stability, more power and higher spindle speeds, the Koping S 8 B is one of fourteen types manufactured in seven sizes. Wide bed casting with high rigid walls braced by strong diagonal ribs. Saddle and tail stock are mounted on separate flame-hardened V and flatways.

The unit features automatic releases on longitudinal and cross feeds. The spindle, which is made with a type L 2 nose has no gears or clutches mounted on it and runs on special precision cylindrical roller bearings with front bearing 4⅛" in diameter.

SPECIFICATIONS

Swing over bed	17⅛"
Spindle speeds, number	18
Spindle speeds in geometric progression	30-1500 r.p.m.
Thread pitches per inch threads, number (and others)	72
Motor	15 HP
Net weight w.o. motor	4850 lbs.



For complete details on this and the other fine Koping lathes and milling machines sold and serviced by Homestrand write: Engineering Dept., Homestrand, Inc., 9 Addison Street, Larchmont, New York.

U.S. REPRESENTATIVE

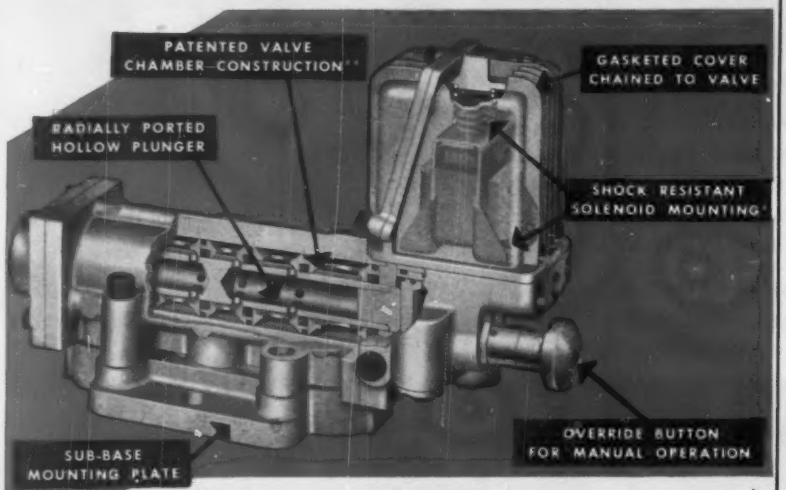
Homestrand INCORPORATED

LARCHMONT, N.Y.

Note: Dealer inquiries invited. Several territories available

Quick-As-Wink®

"B"-TYPE HIGH SPEED, HIGH CAPACITY SOLENOID VALVES


PATENTED VALVE CHAMBER CONSTRUCTION**
GASKETED COVER CHAINED TO VALVE
RADIALLY PORTED HOLLOW PLUNGER
SHOCK RESISTANT SOLENOID MOUNTING*
SUB-BASE MOUNTING PLATE
OVERRIDE BUTTON FOR MANUAL OPERATION

...offer many NEW advantages to make automation less costly and more dependable

Conservatively rated at 600 cycles per minute for continuous operation, these new, high speed valves feature:

1) **SHOCK RESISTANT SOLENOID MOUNTING*** available only in Quick-As-Wink design, reduces destructive hammering and vibration, assuring *greatly increased solenoid life.*

2) **VALVE CHAMBERS** formed by aluminum spacers held in accurate metal to metal end abutment** and sealed with "O" rings and "U" packers.

3) **HOLLOW, RADIALLY PORTED STAINLESS STEEL PLUNGER** directs the flow through the valve. No lapped joints.

4) **GASKETED DIE-CAST COVER** finned for cooling, held with captive screws and chained to valve.

5) **OVERRIDE BUTTON** permits manual operation in case of power failure.

6) **SUB-BASE MOUNTING** permits valves to be inspected — and serviced if necessary — without disconnecting *any* of the piping.

Available also in Double Solenoid, Lever Operated and Pilot Operated Designs.

Get full details about this outstanding new valve. Write for Bulletin No. 561—Today!

*Patent Applied For **U. S. Patent No. 2,645,450

Quick-As-Wink®
AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1942 East Pershing St., Salem, Ohio

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Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besley-Wells Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
American Crucible Products Co., Lorain, Ohio
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio
Challenge Mchry. Co., Grand Haven, Mich.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page* 305)

For more information fill in page number on Inquiry Card, on page 263

GOOD EXAMPLE

of the special machine tools Consolidated can build for you

30 feet high and weighing 140 tons, this Betts 100" worm-and-rack-driven slotter was built for one of the country's leading manufacturers of electrical equipment.

The ram is driven by a variable-voltage, adjustable-speed, direct-current motor. The table, in addition to cross, longitudinal and circular feed, and traverse movements by means of separate variable-voltage motor, has an electrically controlled indexing device. Ram guide and ram stroke adjustment are also electrically controlled.

Next time you're in the market for precision metal-working equipment remember this huge slotter . . . and remember the company that built it. Consolidated has produced more types of machine tools than any other company in the United States.

Detailed information on any of the products listed will be sent on request.

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Rochester 10, N. Y.
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

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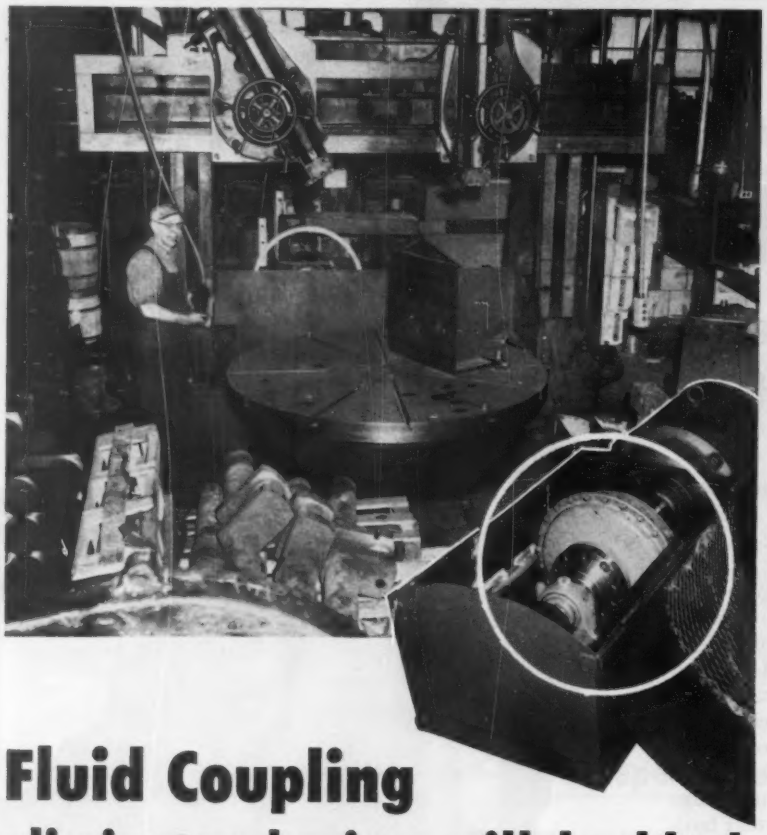
Engine Lathes • Vertical boring and turning mills • Floor and planer-type horizontals • Planers, double housing and openside • Planer-type milling machines • Plate edge planers • Vertical slotters • Rotary and straight-line production-type milling machines • Skin mills for aircraft manufacturing • Circular cold saws • Railroad wheel and axle machinery • Special machine tools.



Fluid Coupling
eliminates boring mill backlash

To *eliminate* blacklash, and to obtain *maximum performance* from a boring mill, Doelger & Kirsten, Inc., Milwaukee, Wis., installed a Twin Disc Model HCM Fluid Coupling between a 25 horsepower motor and the machine.

Prior to this installation, the company had never obtained maximum use of the machine because of backlash. This prevented making maximum cuts at maximum feed, thus impairing the finish.

According to William Reichert, Plant Foreman, "Since installing the Twin Disc Fluid Coupling, we can take extremely heavy cuts at maximum feed. By eliminating backlash, an excellent finish is assured." In summarizing the advantages gained by this installation, Reichert indicated: (1) Inching facilities now extremely good. (2) Gear-teeth chatter has been eliminated. (3) Forward and reverse of motor is no longer a problem. (4) The conversion was economical.

If *your* operation calls for a smooth, cushioned, steady flow of power . . . no motor or engine lugging, stalling or burning out on heavy starts . . . output torque equal to input torque . . . get complete information *now*, about Twin Disc Fluid Couplings—offered in a wide variety of sizes, for any motor or engine application from ¾ to 850 hp. Write Twin Disc Clutch Company, Dept. DS, Racine, Wis. Request Bulletins 144-D and 145-C.

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CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Fluid Couplings

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois
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Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Hartford Spec. Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
La Salle Tool Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Brown & Sharpe Mfg. Co., Providence, R. I.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Rivett Lathe & Grinder Inc., Brighton 35, Boston, Mass.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Coulter, James Mch. Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Reid Bros. Co., Inc., Beverly, Mass.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

(*Continued on page* 308)

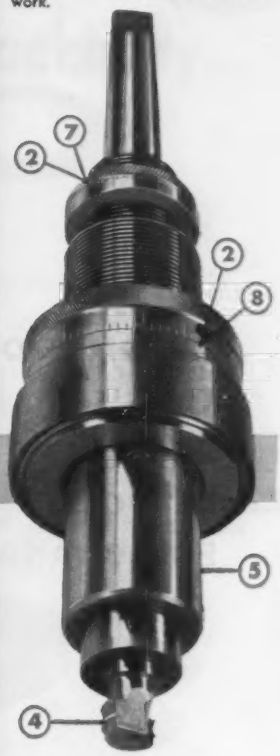
For almost any internal grooving problem . . .

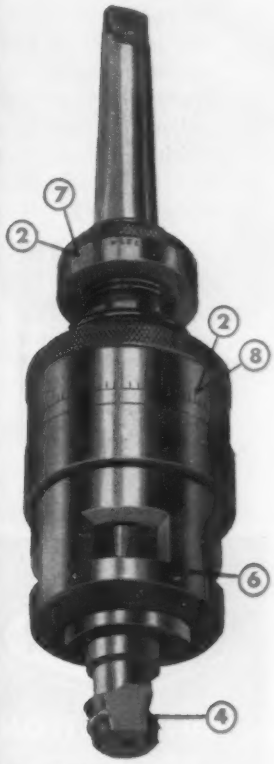
PREMIUM QUALITY RECESSING TOOLS

DESIGNED BY SCULLY-JONES TO CUT CAPITAL AND OPERATING COSTS

These benefits	..for these reasons	..result from these PREMIUM features
REDUCE COSTS	Minimize need for special machinery.	1. Simplify intricate recessing and grooving operations on standard machines, such as drill presses, radial drills, turret lathes, and chucking machines.
	Reduce skill requirements and labor costs.	2. Position tool and control depth of cut automatically.
	Eliminate downtime.	3. Hardened and ground parts assure long life and trouble-free operation on precision work.
	Cut tooling costs.	4. Interchangeable tool bit holders or circular form cutters easily and quickly adapt tool for a variety of special operations.
		5. Hardened and ground steel pilot fits standard bronze bushing.
		6. Interchangeable hardened and ground steel pilot or stop collar made to suit specific requirements. Stops against and pilots in work.
INCREASE ACCURACY	Simplify accurate settings.	7. "Quick-Lock" nut sets depth of undercut to within .001 in.
		8. Adjustable stop collar assembly locates position of undercut in hole to within .001 in.
INCREASE PRODUCTION	Speed operations.	9. Adjustments controlling location and depth of groove are simple and fast.
		10. Positioning of tool and cutting cycle are fast and efficient.

TYPES "J" AND "C"
Pilot in fixture bushing. Can be modified to pilot *in* and stop *against* work.





TYPE "R"
Pilots *in* and stops *against* workpiece.

SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

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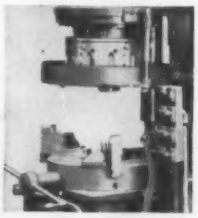
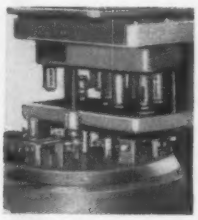
AUTOMATION THAT'S EASILY RETOOLED FOR CHANGES

Baker Basic machines don't have to be "rebuilt" when you change your product or methods . . . cost much less than a machine specially designed for only one part . . . and pay for themselves even on lower production runs. Yet they still give you full automation with loading and unloading devices and conveyors . . . which we'll furnish as well as tooling. Use singly or in battery as a transfer machine . . . for drilling, boring, tapping, facing and other machining operations. 5 sizes.



Boring



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Multiple drilling

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AUTOMATION
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Practical in the short run

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NAME AND TITLE

COMPANY

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Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgwood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16. Ill.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis,
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page* 310)

Where on earth will you find such machinery...

Battery of four No. 4A Warner & Swasey turret lathes for accurate machining of heavy gear blanks to 28" diameter.

...at Illinois Gear, of course.

Pictured here is a battery of large precision turret lathes for machining heavy gear blanks *up to 28" in diameter!*

These machines are typical of all the precision equipment that makes *Illinois Gear* the most modern, best equipped and the largest gear manufacturer in the world . . . equipment that offers a new concept in the manufacture of finest quality gears.

Combine this with the skilled craftsmen who *know how* to operate this equipment and you have the reason why *Illinois Gear* can produce gears that measure up to your most demanding specifications . . . why *Illinois Gear* can make and fulfill delivery promises.

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CHICAGO

Look for this mark ILG® *the symbol on finer gears*

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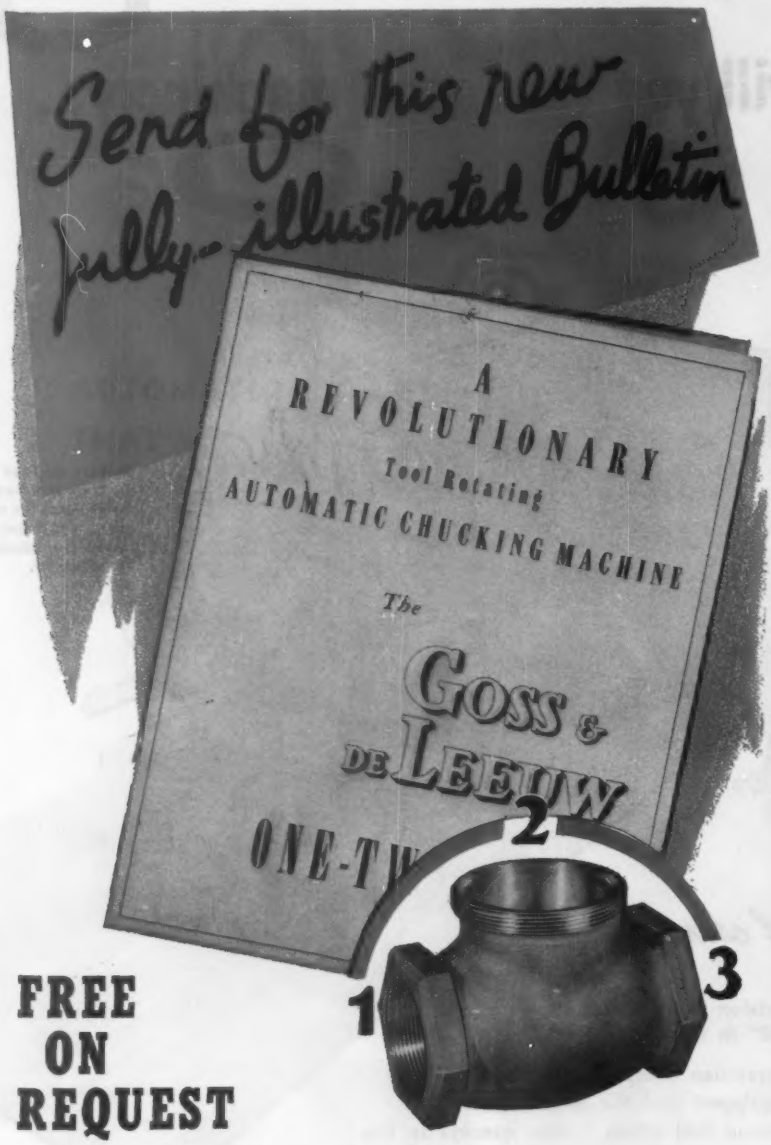

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CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St. Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago, Ill.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Jacobs Mfg. Co., West Hartford 10, Conn.
McCrosky Tool Corp., Meadville, Pa.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co. 254 N. Laurel Ave., Des. Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

(*Continued on page* 312)

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Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment
Spacing Equipment

CLEANERS, Metal
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Rockford Clutch Div., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S. Co., Athol, Mass.

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Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPOUNDS, Resin and Molding
Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y., N. Y.

COMPRESSORS, Air
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Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

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Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Van Keuren Co., Watertown, Mass.
Waltham Mch. Wks., Inc., Waltham, Mass.

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

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Starrett, The L. S., Co., Athol, Mass.

COUPLINGS

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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Twin Disc Clutch Co., Racine, Wis.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

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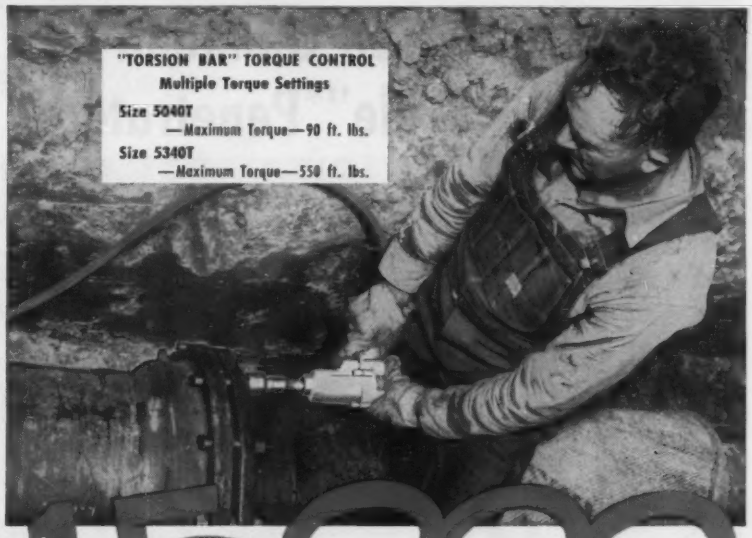

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DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Tomkins-Johnson Co., Jackson, Mich.
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Cities Service Oil Co., 70 Pine St., New York, N. Y.
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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., Penton Bldg., Cleveland 3, Ohio
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
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Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

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(*Continued on page* 316)

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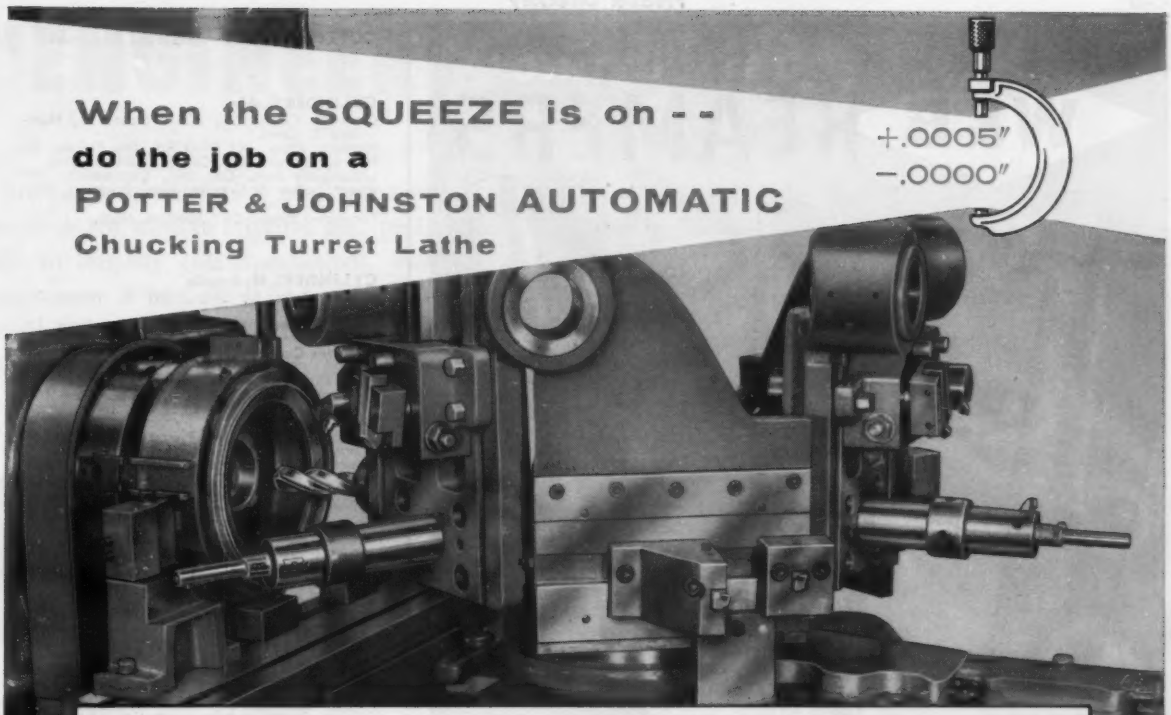

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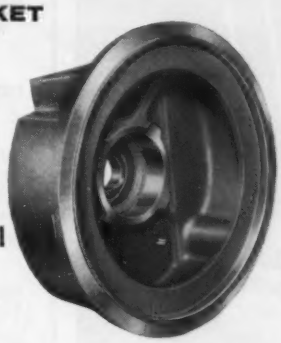

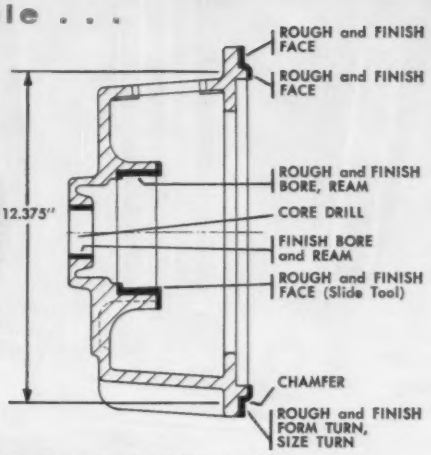

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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
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Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
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Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

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Sheffield Corp., Box 893, Dayton 1 Ohio
Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.

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DIE CASTINGS—See Casting, Die

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Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

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DIEING MACHINES
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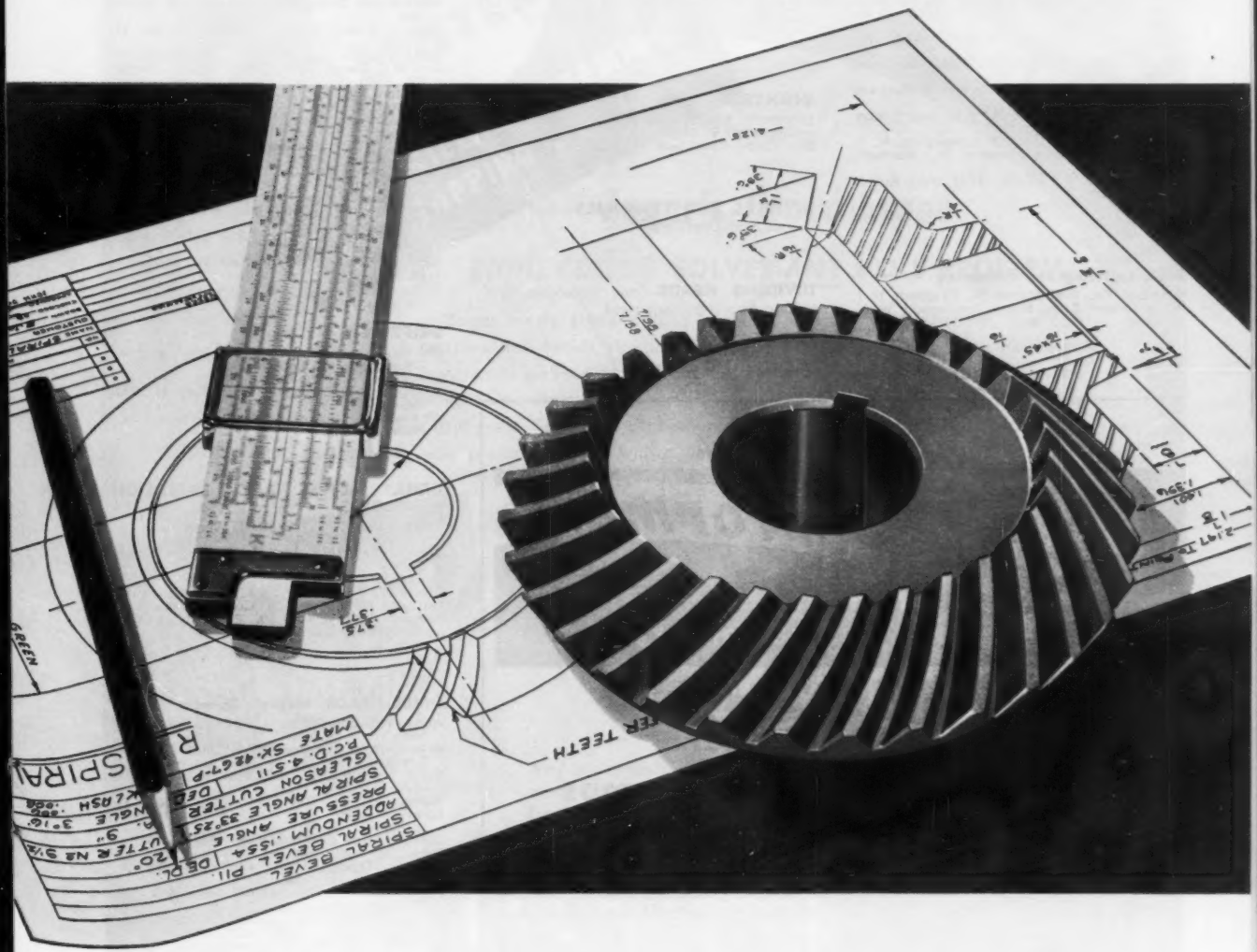
Wales-Strippit Co., No. Tonawanda, N. Y.
Waltham Mch. Wks., Inc., Waltham, Mass.

(*Continued on page* 318)

For more information fill in page number on Inquiry Card, on page 263

"ENGINEERED QUOTATIONS"

When our engineers study our customers' prints, they look for ways to improve gear performance, ways to simplify gear installations, ways to cut gear costs. When they find a way that they consider better they report it to the customer for his consideration. Very often these "engineered quotations" are accepted. Such careful scrutiny of every engineering and manufacturing step by *gear specialists* is one reason why so many manufacturers use Automotive Gear Works as their "gear department". May we submit an "engineered quotation" on your gear requirements?



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Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago, Ill.

DIES, Lettering and Embossing

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Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

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Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springeld, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

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National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISINTEGRATORS

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6.
Stuart Oil Co., Ltd., D. A., 2727 So. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DRIFT KEYS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
DoALL Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

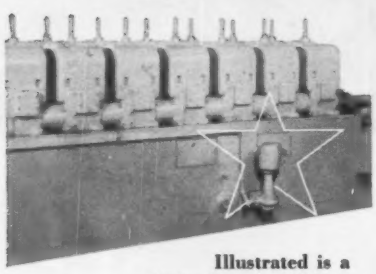
DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 2400 Lakeland Blvd., Cleveland 23, Ohio

(*Continued on page* 320)

Star Performer on METAL WORKING machinery

Ruthman Gusher Coolant Pumps



Illustrated is a Yoder Forming Mill—equipped with a Ruthman Gusher Coolant Pump.

You get instantaneous coolant flow, from trickle to full volume, the moment the machine starts, with a Gusher Coolant Pump. The electronically balanced shaft reduces wear from vibration to a minimum. The pre-lubricated ball bearings require no maintenance attention. From every angle, Ruthman Gusher Coolant Pumps are better.

THE RUTHMAN MACHINERY CO.

1807 Reading Rd. *Cincinnati, Ohio*

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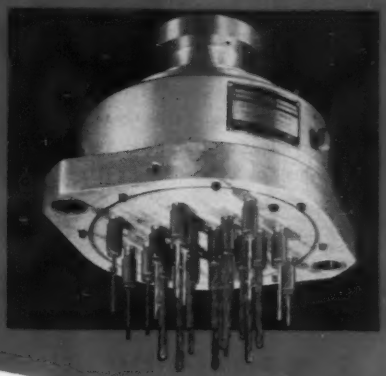
FOR DRILLING, REAMING AND TAPPING . . . . . .



Any hole pattern — on any center up to 1½" dia.

Zagar's Broad-Scope Engineering SOLVES ANY HOLE PROBLEM

Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

ZAGAR, INC., 23888 Lakeland Blvd., Cleveland 23, Ohio

Zagar

TOOLS FOR INDUSTRY and SPECIAL MACHINERY

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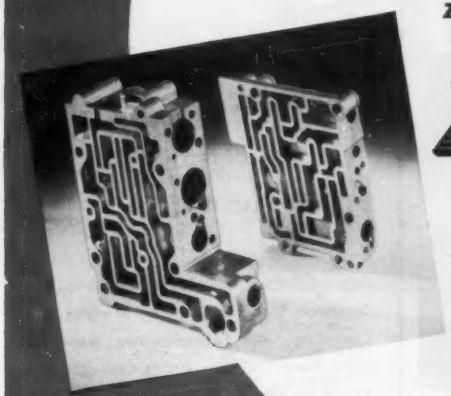
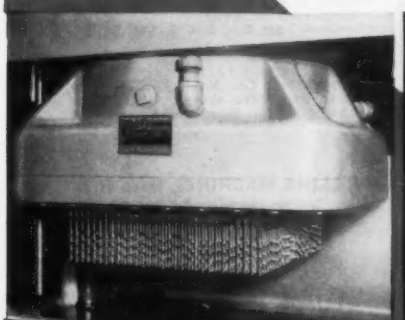
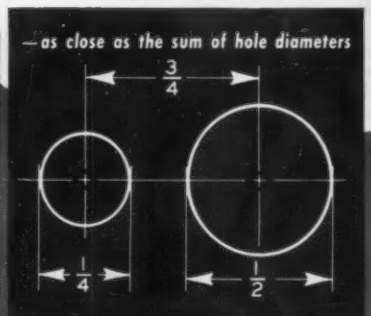
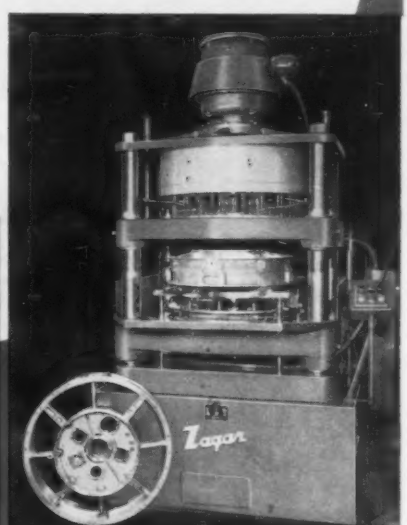


Any machinable material — from all angles.



Up to 1000 holes can be drilled IN ONE PASS.





4-post ram-type drilling machine for aircraft parts.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Automatic

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.

(*Continued on page 322*)

With this new and different slide rule type comparison chart you can check 21 essential specifications of 8 leading heavy duty milling machines. Compare their capacity, speeds, feeds, etc., at a glance.

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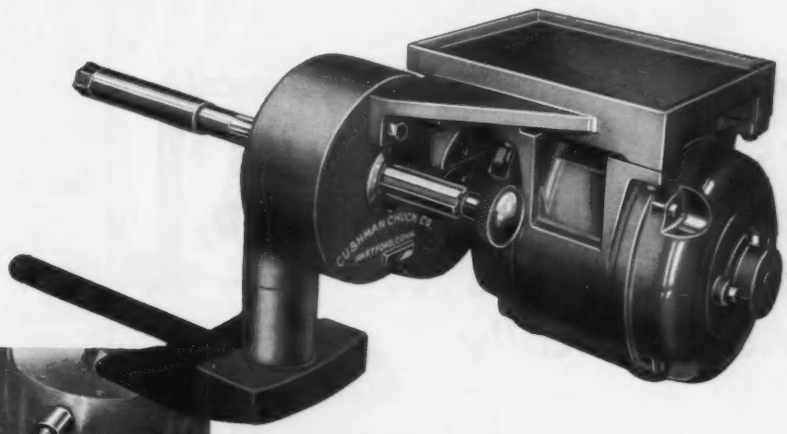
CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

the key to machining efficiency



The Cushman Power Wrench, push-button controlled, eliminates time-consuming, fatiguing, hand wrenching of chucks on single and multi-spindle machines, especially where repetitive machining operations are being performed.

Cushman Power Wrenches are available with either an 8 or 24 ft. lb. motor, delivering a maximum of 180 or 600 ft. lbs. torque respectively. With the addition of the Cushman Variable Torque Control, developed especially for use with the Power Wrench, the operator may, by setting the selector switch, choose any one of 9 approximately equal stages of torque and inertia. Wrenches equipped with 8 ft. lb. or 24 ft. lb. stall-type motors will deliver from 45 to 180 ft. lbs. or 150 to 600 ft. lbs. respectively.

If greater or less driving force is required, the Cushman Engineering Department can design wrenches to suit your needs. Write Cushman for Bulletin No. 211D fully describing and illustrating the Cushman Power Wrench — or, should you have a special work-holding problem, consult Cushman.

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Hartford 2, Connecticut

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Michigan Drill Head Co., Van Dyke, Mich.
Morris Mch. Tool Co., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

DRILLING MACHINES, Sensitive

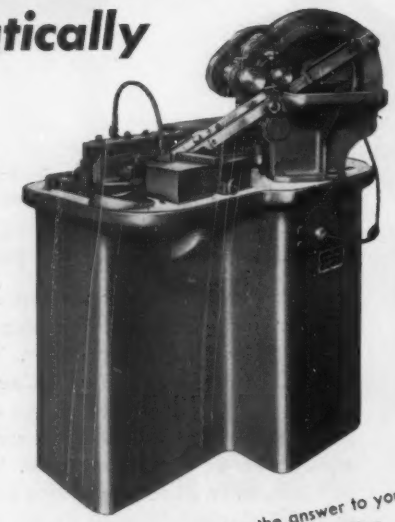
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles 7, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.

(*Continued on page 324*)

15,000 THREADED NAILS per hour with HARTFORD Thread Rollers... *Automatically*



USER REPORT:

From Chas. F. Baker & Co., Framingham, Mass., John P. Hillberg, General Manager: "Hartford Special machines have been more than satisfactory on production and especially economical on up-keep."

QUICK SPECS

Nail Diam. Capacity—.080" to .169"
Thread Length Capacity—⅛" to 2"
Production Rate—250 pcs. per min.
Floor Space Required 4' x 5'
Machine Size—42" x 26" x 52"

Nail down the answer to your nail and screw threading problem. Check the specs.

For detailed information write for Bulletin TR-102.

Machine Tool Accessories Division
THE HARTFORD SPECIAL MACHINERY CO.
29010 Homestead Ave., Hartford, Conn.

HARTFORD Special

For more information fill in page number on Inquiry Card, on page 263

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

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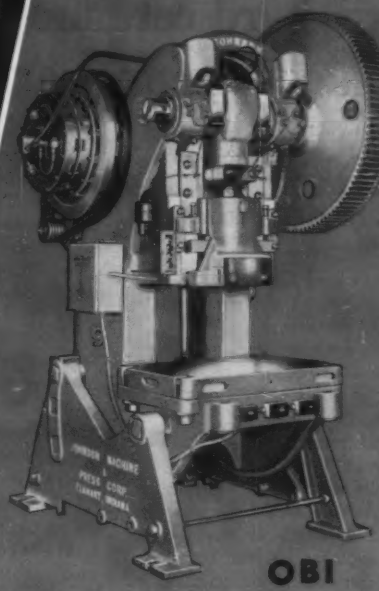
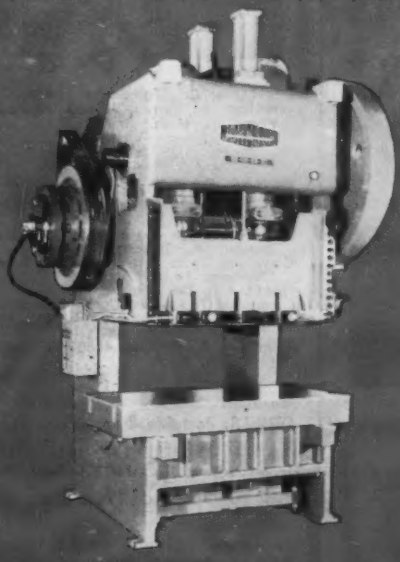


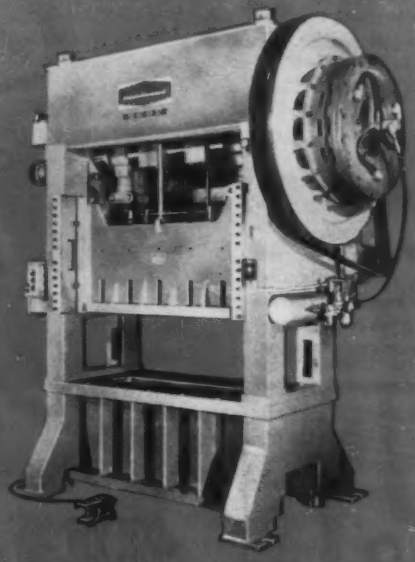
OBI

23 Models ranging from 16 to 150 tons capacity in regular, special wide or high speed types—pin or air clutch.



GAP DOUBLE-CRANK

60-100-125 and 150 ton capacities, steel fabricated, air clutch, flywheel or geared models.



STRAIGHT SIDE DOUBLE-CRANK

40-60-80-100-125 and 150 ton capacities. Tie rod, steel construction and air clutch.

Write for Bulletin 1956

Johnson MACHINE and PRESS CORP.

620 WEST INDIANA AVENUE • ELKHART, INDIANA

Tough, hard ceramic coatings provide superior bearing surfaces

Sprayed alumina forms "sapphire-hard" surfaces highly resistant to wear, abrasion and corrosion. Ideal for bearing surfaces, seals.

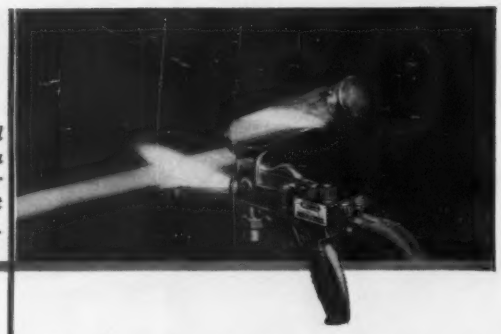
Development of the new METCO THERMOSPRAY GUN for spraying high-melting-point ceramic materials at low cost opens up a variety of new practical applications. One that has produced a great deal of interest is the use of sprayed alumina coatings for bearing surfaces and mechanical seals. This THERMOSPRAY 101 Ceramic Powder produces surfaces with a hardness of 9.0 on the Moh scale, (only the diamond rates 10.0) with excellent resistance to wear, abrasion and corrosion. When used in combination with special phenolic or furane plastic sealers it provides superior protection against many acids.

Another THERMOSPRAY Powder – 201 – is zirconia which is somewhat softer than No. 101 but provides superior heat-insulating properties. Melting point of this material is 4600° F. and particle hardness 8.0 on the Moh scale.

Hard-facing alloys of the self-fluxing, nickel-boron-silicon type in powder form can also be applied with the METCO Type P THERMOSPRAY GUN. These coatings may be fused, semi-fused, or left unfused depending on the hardness desired, from RC 30 to RC 65, depending on the alloy and the process used.

The new THERMOSPRAY GUN operates without compressed air, only oxygen and acetylene being required. The free-flowing THERMOSPRAY powders are fed to the flame nozzle from a hopper atop the gun, melted and propelled to the surface to be coated. These materials are sprayed many times faster (up to 15 sq. ft. per hour—.010" thick) than has been possible with equipment previously available. Deposit efficiencies are in excess of 95%. These factors result in extremely low coating costs.

Preliminary engineering data contained in Bulletin 127 covers ceramic coatings while Bulletin 126 covers the hard-facing alloys. Either or both may be obtained by filling out the coupon below or writing on your company's letterhead. No obligation, of course.



Pump rod sprayed with alumina provides superior protection against abrasion and corrosion.

free bulletins
(See last paragraph above)

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METCO®

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1131 Prospect Ave., Westbury, L. I., New York

Please send me ☐ free Bulletin 127 (ceramic coatings)
☐ free Bulletin 126 (hard-facing).

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City Zone State

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

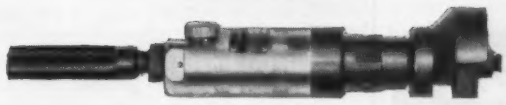
(Continued on page 326)

For more information fill in page number on Inquiry Card, on page 263

NEW! THREE THOR AIR GRINDERS

Power stepped up! **Weight cut down!** **Fewer parts!**

Model 5V
Vertical Grinder



Model 25G Die Grinder

Series 3G Grinders for Castings

All three of these brand new additions to Thor's complete grinder line represent distinct progress in power, in weight reduction, and design improvement. All have thumb-type throttle control.

Model 5V Vertical Grinder

This new Thor 7½-lb. vertical grinder is available in three basic speeds — 4,500, 6,000, or 8,000 r.p.m. It accommodates sanding discs to 9″ diameter, depressed center wheels to 7″ diameter, and cup wheels or wire brushes to 6″ diameter. Power has been increased 50%; quiet exhaust; 4-position throttle.

Model 25G Die Grinder

Designed for use with a 1¾″ bonded wheel in die work and other production operations, this new Thor Model 25G weighs only 2 lbs., 37% less than its Thor predecessor, yet it develops 23% more power! Model 25G also has 35% fewer parts. Speed: 20,000 r.p.m.

Thor
PORTABLE POWER
TOOLS

Model 3G Series for castings

Available in speeds of 7,000, 10,000, 15,000, and 18,000 r.p.m., this new Thor Series 3G takes wheel sizes from 1½″ to 3″, depending on speed. Here, again, the weight has been cut to 3 lbs., 11 oz., a saving of 16%, while power has been increased 18%. Also available in Series 3GE with an extension spindle to reach hard-to-get-at places.

Thor's complete line of air, universal electric, and high frequency electric grinders includes sizes, speeds and capacities for every industrial need. Thor also offers a complete line of grinder accessories. Thor Power Tool Company.

THOR POWER TOOL COMPANY, Aurora, Ill.

Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Houston • Los Angeles • Milwaukee • Newark • Long Island City, N.Y. • Philadelphia • Pittsburgh • St. Louis • San Francisco • Seattle • Toronto, Canada • Export Division, New York City

Performance Record

DRILLS, Subland
Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Van Dyke, Mich.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Ind.
Cuno Engineering Corp., Meriden, Conn.
DeLaval Separator Co., Poughkeepsie, N. Y.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

(Continued on page 328)

Another of the Reasons Behind Brad Foote Quality—

METALLOGRAPHY

• The heat treatment a gear receives is probably the most important single factor in determining its long range wear characteristics. Here at BRAD FOOTE we pride ourselves on having equipment designed to provide the widest possible variety of heat treatments.

• But in addition to standard heat treating and testing equipment we have a few extra safeguards. One of these, rather unusual in our business, is a complete Metallographic laboratory. Specialized equipment allows us to examine or photograph the grain structure of all of our metals, in order to determine the most effective methods of heat treatment and to serve as a check on the quality of finished work.

• Metallographic examination is just one of the many reasons behind BRAD FOOTE quality. Prove to yourself the savings this extra quality can mean. Let us quote on the gear requirements for your next program, without obligation.

BRAD FOOTE MAKES ALL TYPES OF GEARS—IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.
1309 South Cicero Avenue • Cicero 50, Illinois
Bishop 2-1070 • OLympic 2-7700 • TWX CIC-2856-U

subsidiaries
AMERICAN GEAR & MFG. CO. Lemont, Illinois • Phone Lemont 920
PITTSBURGH GEAR COMPANY Pittsburgh 25, Penn. • Phone SPalding 1-4600

For more information fill in page number on Inquiry Card, on page 263

throughout industry—today's job records prove

modern

High Speed Steels

-correctly applied-

show lowest costs

per cu. in. of metal removed

Today's High Speed Steels keep pace steadily with the ever-higher production requirements of American industry. Improvement in quality and advances in heat-treating techniques combine to produce High Speed Steels cutting at speeds 15 to 100% faster than ever before—lasting longer between grinds than ever before!

Tougher than carbides, modern High Speed Steels are *stronger* than carbides, less subject to breakage or edge chipping, *and cost less* than carbides.

We invite you to join the majority of up-to-date users of cutting tools who specify modern High Speed Steels for 90% of their jobs *and profit* accordingly. Write us for a complete, objective survey of your cutting problems by trained sales engineers.

Vanadium-Alloys Steel Company

Pioneers in the development of M-2 High Speed Steel and High Carbon, High Vanadium High Speed Steels

Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

Performance Record

Steel—Vasco Supreme **Tool or Die**—Tool Bit
Work—Boring locomotive piston rings
Remarks—30 pcs. per grind. Carbide tools: broke on first piece.

Performance Records

Performance Record

Performance Record

Tool or Die—Rough Facing Tool
Steel—Vasco Supreme
Work—Rough & finish facing cast connecting rods.
Remarks—28 pcs. per grind, 150 pcs. per tool. Carbide, 8 pcs. before breaking.

Performance Record

Performance Record

Performance Record

Steel—Neatro **Tool or Die**—Core Die
Work—Molding iron powders
Remarks—Replaced carbide on basis of cost and performance.

Performance Record

Steel—Vasco Supreme **Tool or Die**—Scalping Die
Work—Removing surface of brass, bronze and copper tubing
Remarks—199,000 ft of tubing and still in good condition. Carbide: broke at 141,000 ft.

Performance Record

Steel—Vasco Supreme **Tool or Die**—Lamination Die
Work—Blanking .025" sheet
Remarks—230,000 pcs. per grind: 10,000,000 pcs. per die. Carbide: die broke at 33000 pcs.; another at 550,000 pcs.

Performance Record

Steel—Vasco Supreme **Tool or Die**—Tool Bit
Work—Turning cold rolled C-115
Remarks—Produced twice as many pieces per tool as carbide tools, at rate of 3600 pcs. per day.

Performance Record

Steel—Red Cut Superior **Tool or Die**—Form Cutter
Work—Form cutting bearing races
Remarks—1st day of test: Vasco Supreme 157 pcs.; Red Cut Superior 100 pcs.; carbide 35 pcs. 2nd day: Vasco Supreme 193 pcs.; Red Cut Superior 126 pcs.; carbide 35 pcs.

FINISHES, Machine and Metal
Conforming Matrix Corp., Toledo, Ohio
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Ajax Electric Co., Frankford at Delaware, Philadelphia 23, Pa.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

FORGING, Machines, Headers, Upsetters
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING MACHINES, Cold-rolling
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 330)

STANDARD HEAVY DUTY SUPER PRECISION SPINDLES

"Masters of Milling"

No. 6027 MY

No. 6009 M

AMERICA'S MOST EXTENSIVE LINE OF MILLING SPINDLES!

From 1 to 200 HP with standard tapers, #20 to #60. To satisfy every milling demand — enclosed, totally enclosed fan-cooled, high cycle and liquid-cooled. Motorized or Belt-Driven. Variable, single or multiple speed motor — Speed to suit your application.

A milling spindle for every purpose . . . and more than that . . . a milling spindle reflecting in its SUPER CAPACITY AND TROUBLE FREE OPERATION the four decades of its maker's experience in spindle manufacturing. And "special problems"? . . . get the answer from Standard experts!

Booth 1047 • METAL SHOW • Cleveland • Oct. 8-12

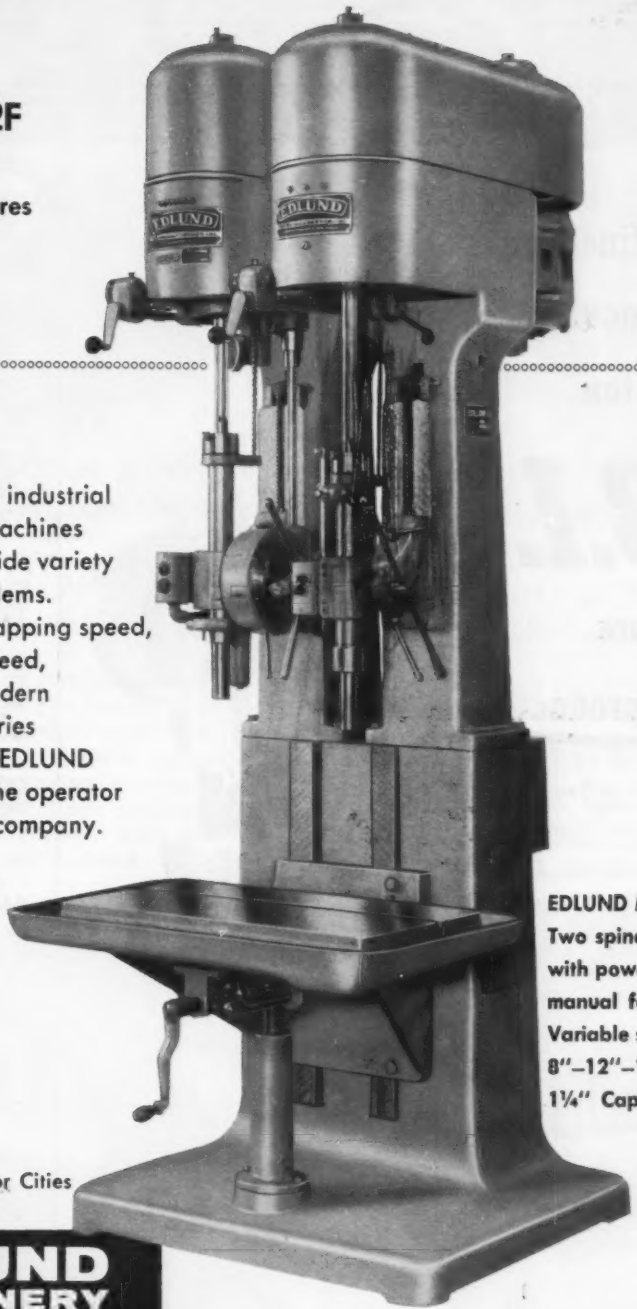
SUPER PRECISION SPINDLE DIVISION
the STANDARD electrical tool co. SINCE 1912
STANDARD SETS THE PACE!
TRADEMARK OF CRAFTSMANSHIP THROUGHOUT THE WORLD
2500 RIVER ROAD • CINCINNATI 4, • OHIO

EDLUND

AMERICA'S MOST VERSATILE DRILLING MACHINE

EDLUND Model 2F

Infinitely Variable Speed
Modern Production Features
Long Lasting—
Rugged Construction



The changing pattern of industrial production requires machines readily adaptable to a wide variety of production problems. Selection of **any** drilling or tapping speed, manual or power feed, and many other modern production accessories make operation of the EDLUND Model 2F a pleasure for the operator and good sense for the company.

Write for Bulletin 140R.

EDLUND Model 2F
Two spindle combination with power feed and manual feed.
Variable speeds to 3600 rpm
8"–12"–15" Overhang
1¼" Capacity

EDLUND Representatives in Major Cities

EDLUND MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

Write for Bulletin G56 — Complete Line with Cam Feed Units
Bulletin 160 — Model 1F–High Speed
Bulletin 170R— Model 4F–Production

For more information fill in page number on Inquiry Card, on page 263

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Dial, Bore, Height, Depth, Thread, Groove, etc.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co. 47 Farwell St. Waltham 54 Mass.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co. Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness
DoALL Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Vernier, Height, Depth, Gear Tooth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.

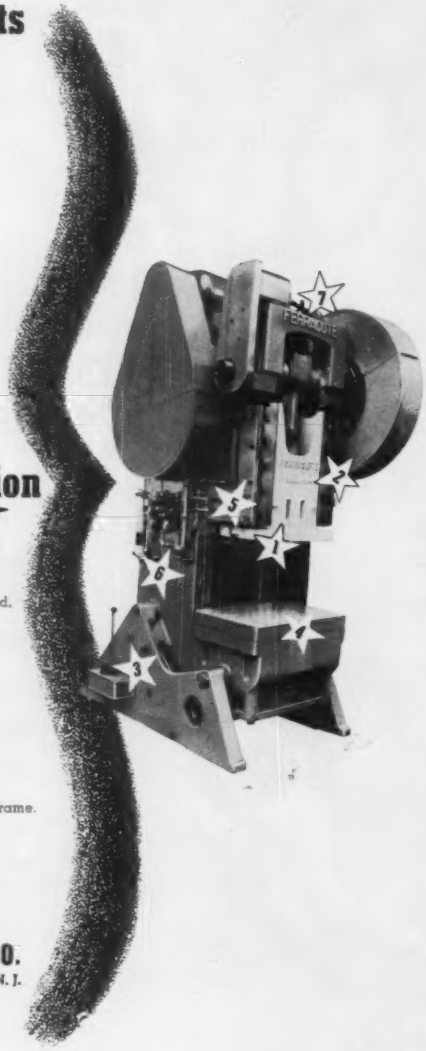
GEAR BURNISHERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

(*Continued on page* 332)

These refinements on Ferracute's new 110-ton

O.B.I.

mean more profitable production

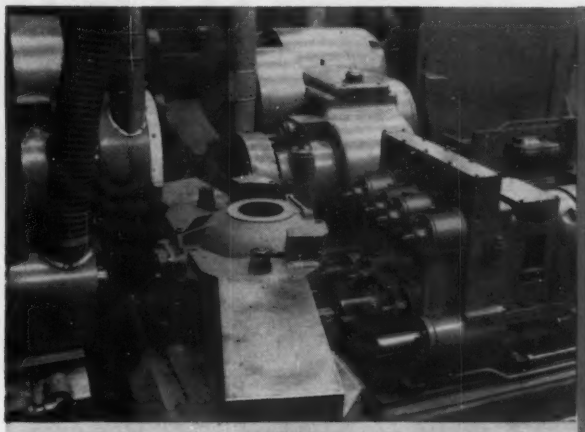


1 Box-type ram construction, gibbed front and back.
2 Air-operated, electrically controlled, interconnected clutch and brake.
3 Hydraulic inclining mechanism.
4 Bed arranged to accommodate die cushion.
5 Ram, air counterbalanced.
6 Floor-level, one-point lubrication.
7 Two lifting eyes mounted in press frame.

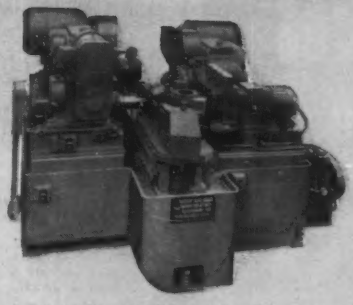
FERRACUTE

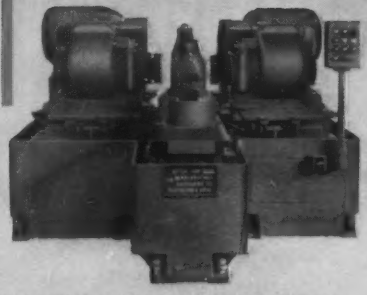
Write for complete information.

FERRACUTE MACHINE CO.
469 East Commerce Street, Bridgeton, N. J.
Manufacturers of Power Presses, Press Brakes and Special Machinery



Three stations rough and finish machine: (1) mill, (2) drill, bore, (3) ream gear box castings.





Duplex milling at different levels: 4 sides milled, two sides simultaneously, with rotary rise-fall index table.

TWO MOTCH & MERRYWEATHER MACHINES CONTRIBUTE TO FULL AUTOMATION AND REDUCE MACHINING TIME 1/3!

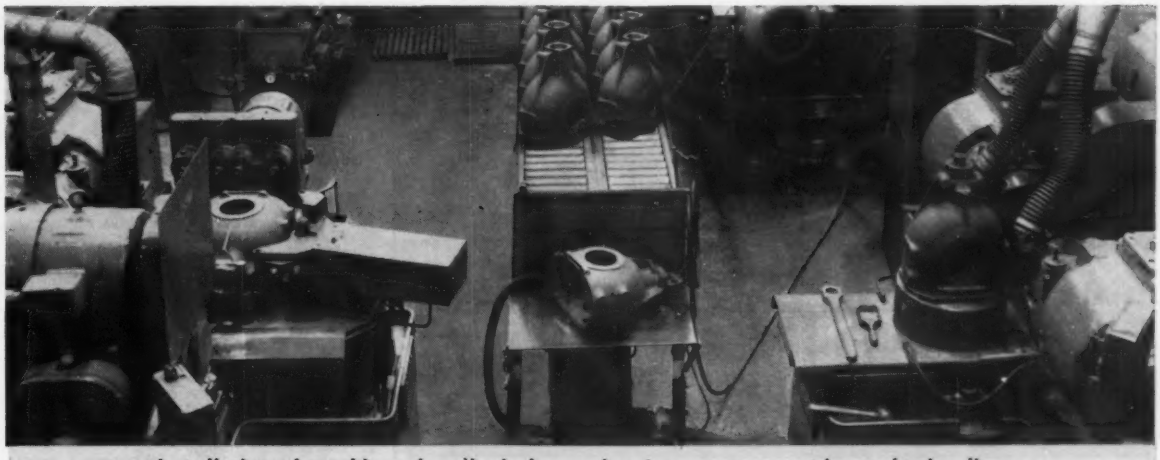
FARM MACHINERY COMPANY Gets Cost-Reducing Boost with a Motch & Merryweather Production Solution

A "production solution" by Motch & Merryweather will invariably be the lowest cost way to get the highest production of new parts or to reduce current manufacturing costs. Efficient fixturing, using standard units, and combining operations produce results which compare favorably with the most automatic production systems. First or last, but always, get a production proposal from Motch & Merryweather.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 3, OHIO



Installation of machines described above, showing arrangement in production line.

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Mch. Wks., Inc., Waltham, Mass.

GEAR GRINDERS—See Grinding Machines, Gear

BURR-MASTER
For Every Gear Deburring Job

You can't afford obsolete methods when Burr-Masters can "deburr and chamfer" gears and splines up to 300 teeth per minute!

Universal machines for internal gear and spline deburring. Data in Bulletin 103-81.

Hypoid pinion deburring machines are available in single or multiple station models. Data in Bulletin 103-100.

Eight Universal models, single or two station, deburr and chamfer spur or helical gears and external splines. Get complete data in Bulletin 103-60.

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Industrial Engineering Co.
14230 BIRWOOD AVE. DETROIT 38, MICHIGAN

GEAR HOBBERS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 2, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Nonmetallic
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G. St., Philadelphia, Pa.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago, Ill.

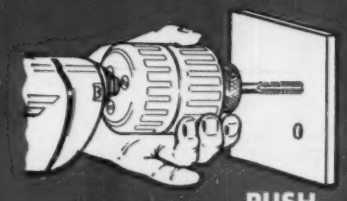
(*Continued on page* 334)

NEW!

NEVER BEFORE A TOOL LIKE THIS!

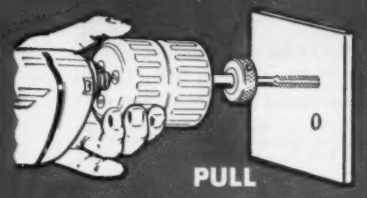
TAPPING to highest industry standards with ordinary portable drills

HOW IT WORKS . . .



PUSH

and the tap runs in smoothly . . .

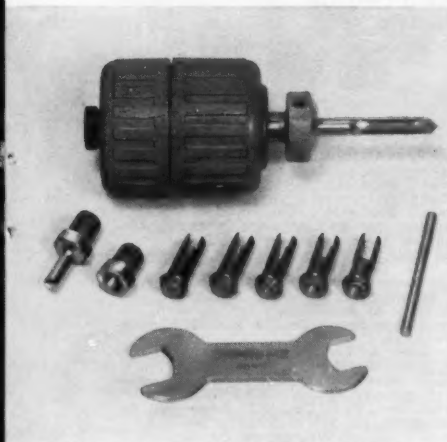


PULL

and it comes out easily . . . That's all you do **PUSH-PULL!**

Cut tap breakage with the easy to use, safe to use

SUPREME **Push·Pull Tapper**



Complete PUSH-PULL TAPPER Kit includes 5 collets to handle all taps up to 5/16" diameter. List price is **$29.95** complete. (Taps not included.)

Big shops and small shops alike will find this new tool the answer to hundreds of tapping problems. It is small, light, safe to use, and inexpensive, yet it will solve most of your tapping problems.

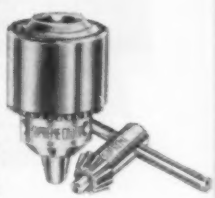
The *Supreme PUSH-PULL TAPPER* is an instant-reversing speed reduction unit made expressly for tapping. By means of the adapters it can be attached easily to either the spindle or chuck of any portable drill. Detachment after use is equally simple. The speed reduction of 7:1 gives more than adequate power to tap in all materials, and the instant-reversing means that the direction of the tap can be reversed without stopping the drill motor. Thus the tap can be moved into and out of the hole at will.

Tap breakage is held to an absolute minimum when the *PUSH-PULL TAPPER* is used. This is because the operator has a better "feel" for his work. When in use the *TAPPER* housing is held in the finger-tips, and any unusual strain is felt immediately. Releasing the fingers stops the tap instantly.

One owner, using the *PUSH-PULL TAPPER* on an important government job, tapped 1500 holes in one casting without one deficient hole, and without a single broken tap. Another decreased the amount of tap breakage enabling them to change to a tapping operation that resulted in increased assembly production.

Examine your own tapping operations, and you'll see that the *PUSH-PULL* has advantages you can utilize. It handles all taps up to 5/16" diameter, and the five necessary collets are included. Also included are wrenches for tightening collets and for removing or tightening *PUSH-PULL TAPPER* to drill spindle. Ask your Mill Supply Distributor or write direct.

By the makers of Supreme Brand Chucks



These chucks are "Up Front on leading power tools."

Look for these great chucks on the new tools you buy . . . specify them for all replacement. The exclusive Supreme hardening process assures long, accurate, trouble-free service.

SUPREME PRODUCTS CORPORATION

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GEARS, Cut

Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Brad Foote Gear Wks., 1309 So. Cicero Ave., Chicago 50, Ill.
Cincinnati Gear Co., Wooster Pike and Mareimont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Inc., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GEARS, Stamped

Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric

General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
South Bend Lathe Works, South Bend 22, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearny & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Waltham Mch. Wks., Inc., Waltham, Mass.

(*Continued on page* 336)

For most economical threading on all Automatic Screw Machines, Chucking machines, Bolt threaders, Drill presses, etc.

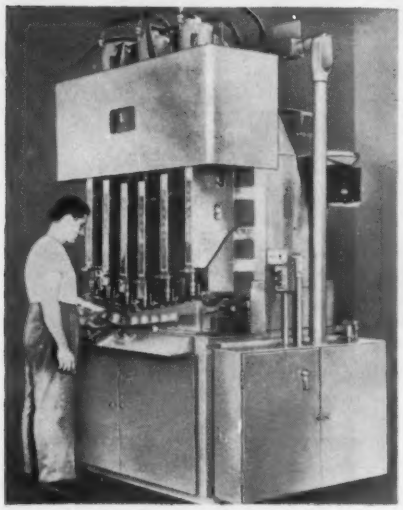
H & G insert chasers

CUT YOUR COSTS AND DOWN TIME

For less than $45 you get 12 sets of ¾-16 (or any stockable size) Insert Chasers; each set ground ready for business. This dozen sets can thread hundreds of thousands of parts with no down time or sharpening time. Can be thrown away when dull or if you prefer, flash grind the dull sets and make an extra profit. Threads stand critical examination and conform to the close tolerances of Class 3 fits. Send for our digest of the Government publication, "UNIFIED AND AMERICAN SCREW THREADS".

THE EASTERN MACHINE SCREW CORPORATION 23-43 Barclay St., New Haven, Conn.

ORANGE *Cage Type* NEEDLE BEARINGS



● Model SD 10-12 Stud Driving Machine manufactured by Syracuse Special Machine Co., Inc., Syracuse, N. Y., drives one to 12 studs simultaneously. Other models also available.

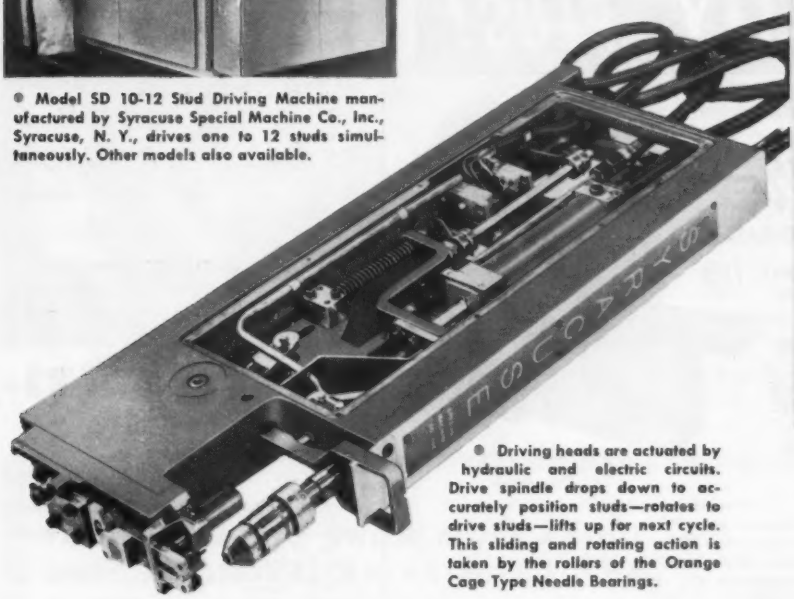
handle both reciprocating and rotating action in this Stud Driving Machine

•

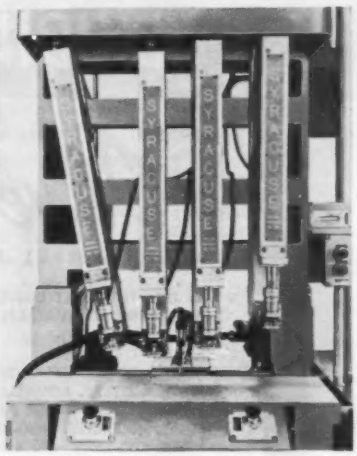
"Long life and smooth operation"

reports

Syracuse Special Machine Company, Inc.



● Driving heads are actuated by hydraulic and electric circuits. Drive spindle drops down to accurately position studs—rotates to drive studs—lifts up for next cycle. This sliding and rotating action is taken by the rollers of the Orange Cage Type Needle Bearings.



● Driving heads may be angled up to 30° from vertical.

This unusual application emphasizes the value of the Orange cage design which keeps rollers in alignment to prevent skewing under all operating conditions—assuring true running in any position, whether horizontal, vertical, tilted or on overhung mountings.

Orange Cage Type Needle Bearings provide high load capacity in small space—run evenly and quietly—give long service.

Orange Cage Type Needle Bearings are compact, heavy-duty, precision bearings available in stock sizes from ½″ to 8″ shaft dia., interchangeable with all standard needle bearings. Write for Engineering Manual M-56.

ORANGE
ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
552 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers

For more information fill in page number on Inquiry Card, on page 263

GRINDERS, Toolpost
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Broach
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

FLEXIBILITY—PLUS!

THE Oliver— FACE MILL GRINDER

- TRULY—THE MOST UNIVERSAL FACE MILL GRINDER AVAILABLE.
- DESIGNED SPECIFICALLY FOR THOSE "HARD TO GRIND" CLOSE PITCH CUTTERS. EQUALLY EFFICIENT FOR OTHER FACE MILLS, SIDE MILLS, CHANNEL MILLS, ETC.
- UNIVERSAL ADJUSTMENTS INCLUDE:

CAPACITY—4" TO 24" DIA. MILLS

* Cross carriage travel ⟷ 5" either side of center
* Horizontal travel of grinding unit ⟷ 7".
* Maximum travel of base table ⟷ 20".
* Angular adjustment of wheel spindle head ↶ 180°.
* Angular adjustment of work spindle ↶ 180°.
* Swivel adjustment of work spindle ○ 360°.
* Maximum elevation of work spindle ↕ 15".
* Vertical adjustment of wheel spindle ↕ 1½".

- SET-UP IS ASTOUNDINGLY SIMPLE REGARDLESS OF ANY COMBINATION OF POSITIVE OR NEGATIVE RAKE ANGLES ON EITHER THE RADIAL OR AXIAL DIMENSIONS.

The Oliver line also includes the Hydraulic Automatic Face Mill Grinder and the #2 Arc Radius Cutter Grinder.

Oliver INSTRUMENT • COMPANY

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FACE MILL GRINDERS • AUTOMATIC DRILL GRINDERS • DIE MAKING MACHINES
TOOL & CUTTER GRINDERS • DRILL POINT THINNERS • TEMPLATE TOOL GRINDERS

GRINDING MACHINES, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

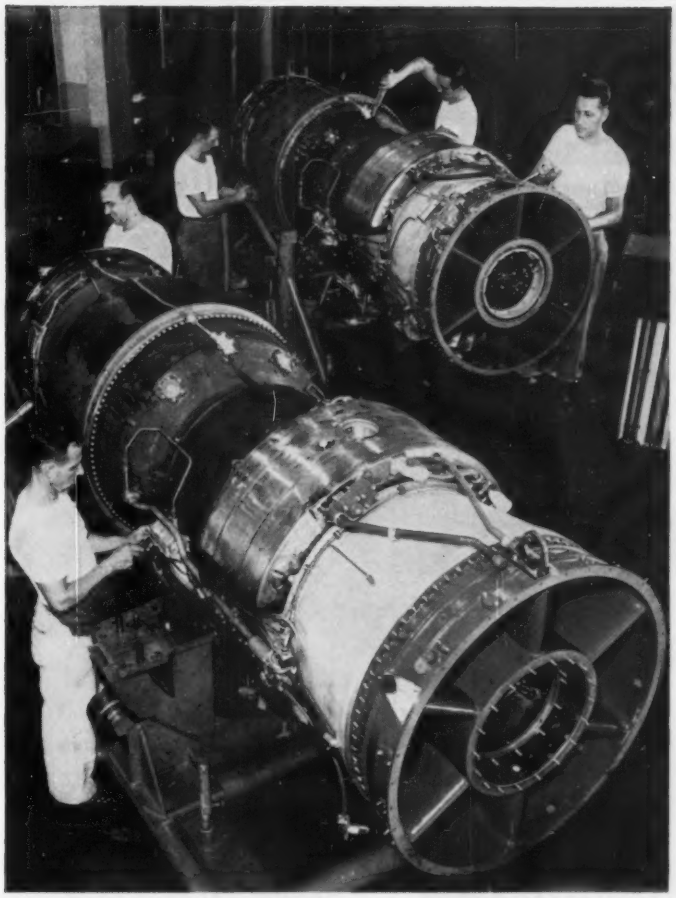
GRINDING MACHINES, Disc
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

(*Continued on page* 338)



Pratt & Whitney's **J-57** *Turbojet: The most powerful aircraft production engine in the world is rated in the 10,000-pound thrust class.*

Why Pratt & Whitney Uses 19 Gear Grind Machines to Guarantee Performance in the World's Most Powerful Aircraft Production Engine

At Pratt & Whitney Aircraft, where finest quality gears and high production are essential to the manufacture of the J-57 Turbojet, 19 new automatic Gear Grind Machines are in daily use. Here is what Pratt & Whitney has to say:

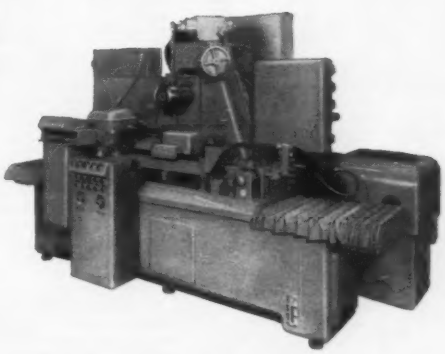
"The new Gear Grind Machines presently used in the aircraft engine division are the first major development in this type of machine since their use at Pratt & Whitney. They were developed in cooperation with Pratt & Whitney engineers to meet the specific and exacting requirements of modern aircraft engine gears. These machines are equipped with a new wheel-trimming feature and a two-speed spindle drive to eliminate burning.

"Another advantage is the relative ease with which the involute profile can be modified."

YOU'LL WANT TO KNOW MORE ABOUT THESE ADDITIONAL ADVANTAGES FOUND IN THE NEW GEAR GRIND AUTOMATICS

- Controlled flow of coolant through the grinding wheel insures non-tempered, case-hardened gears.
- Single or double diamond trimmers are used to assure a perfect blend between the tooth profile and the root fillet.
- Automatic trimming of the grinding wheel assures uniformly accurate work.
- Available as fully automatic machines incorporating automatic loading and unloading.

Write today for comprehensive eight-page brochure which explains the details.



For gears up to 36" diameter.

The Gear Grinding Machine Company

56-B

3921 Christopher, Detroit 11, Mich.

Manufacturers of:
The Detroit Screwmatic 750, Automatic Screw Machines. RZEPPA ("Sheppa") Constant Velocity Universal Joints

GRINDING MACHINES, Profile

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Rotary

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

GRINDING WHEEL DRESSING AND FORMING DEVICES

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
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Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Bakelite Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., N. Y., N. Y.
Besley-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

(*Continued on page* 342)

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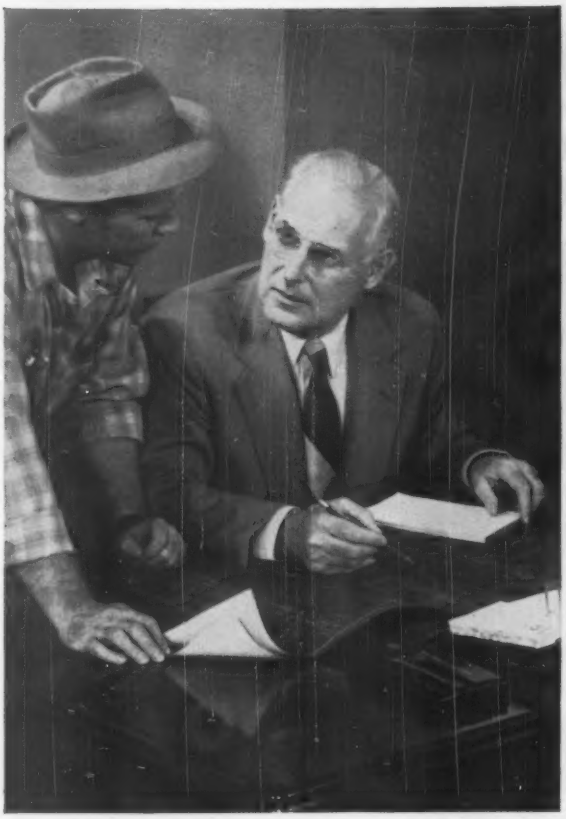

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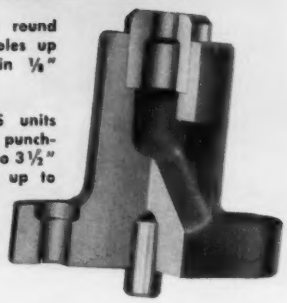

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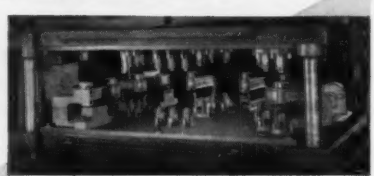

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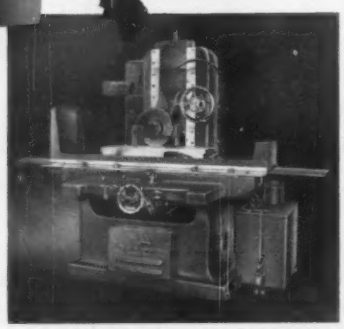

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(*Continued on page* 344)

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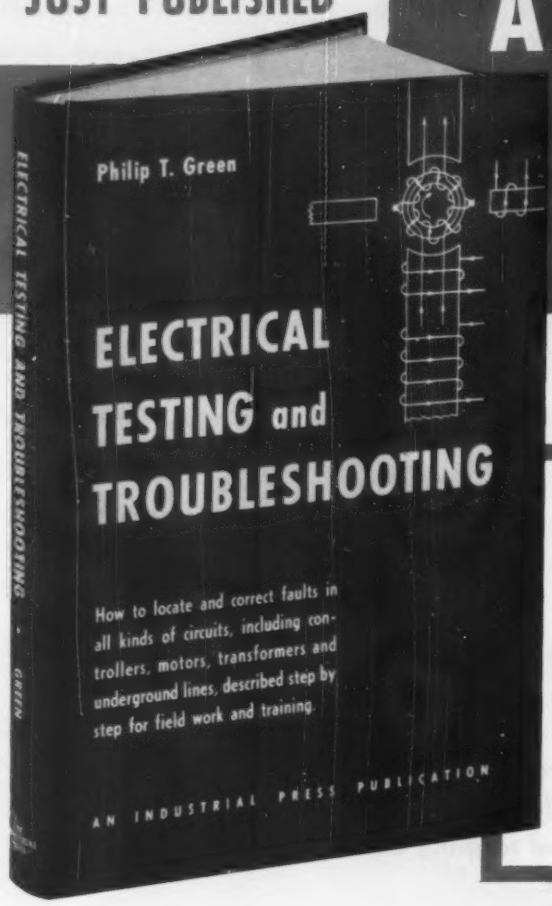
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General Discussion and List of Pieces Needed—Special Test Panels—Special Test Bell Set

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Insulation Resistance Measurements: Megger, Series ohmmeter, Voltmeter and separate battery, Voltmeter and internal voltage of circuit—Insulation Resistance Behavior

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Phase Sequence

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About the Author

Philip T. Green, the author of ELECTRICAL TESTING AND TROUBLESHOOTING, is Industrial Training Coordinator of the Panama Canal Zone Company. He has been associated with this organization since 1937. Previously he had been a Teaching Fellow at the University of Cincinnati, where he received both his B.S. and M.S. degrees in Electrical Engineering. In addition to his background in industrial training and electrical engineering, the author has also served as educational advisor to units of the International Brotherhood of Electrical Workers.

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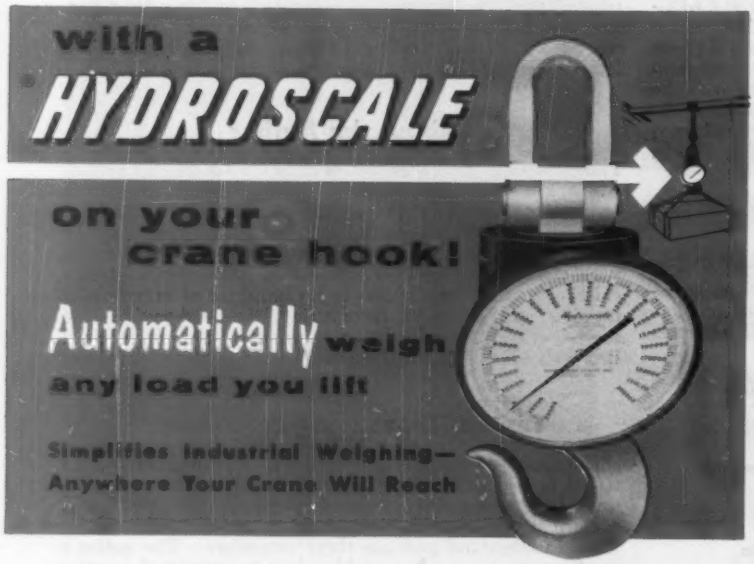

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DoALL Co., Des Plaines, Ill.
duMont Corp., 289 Wells St., Greenfield, Mass.
Starrett, L. S. Co., Athol, Mass.

INDICATOR LIGHTS—See Lights, Indicator

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

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General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

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Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

JACKS, Planer—See Set-up Equipment

JIG BORERS

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Conforming Matrix Corp., Toledo, Ohio
Fulmer Co., C. Allen, 1211 - 1st Nat. Bank Bldg., Cincinnati 2, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Waltham Mch. Wks., Inc., Waltham 54, Mass.

(*Continued on page* 348)

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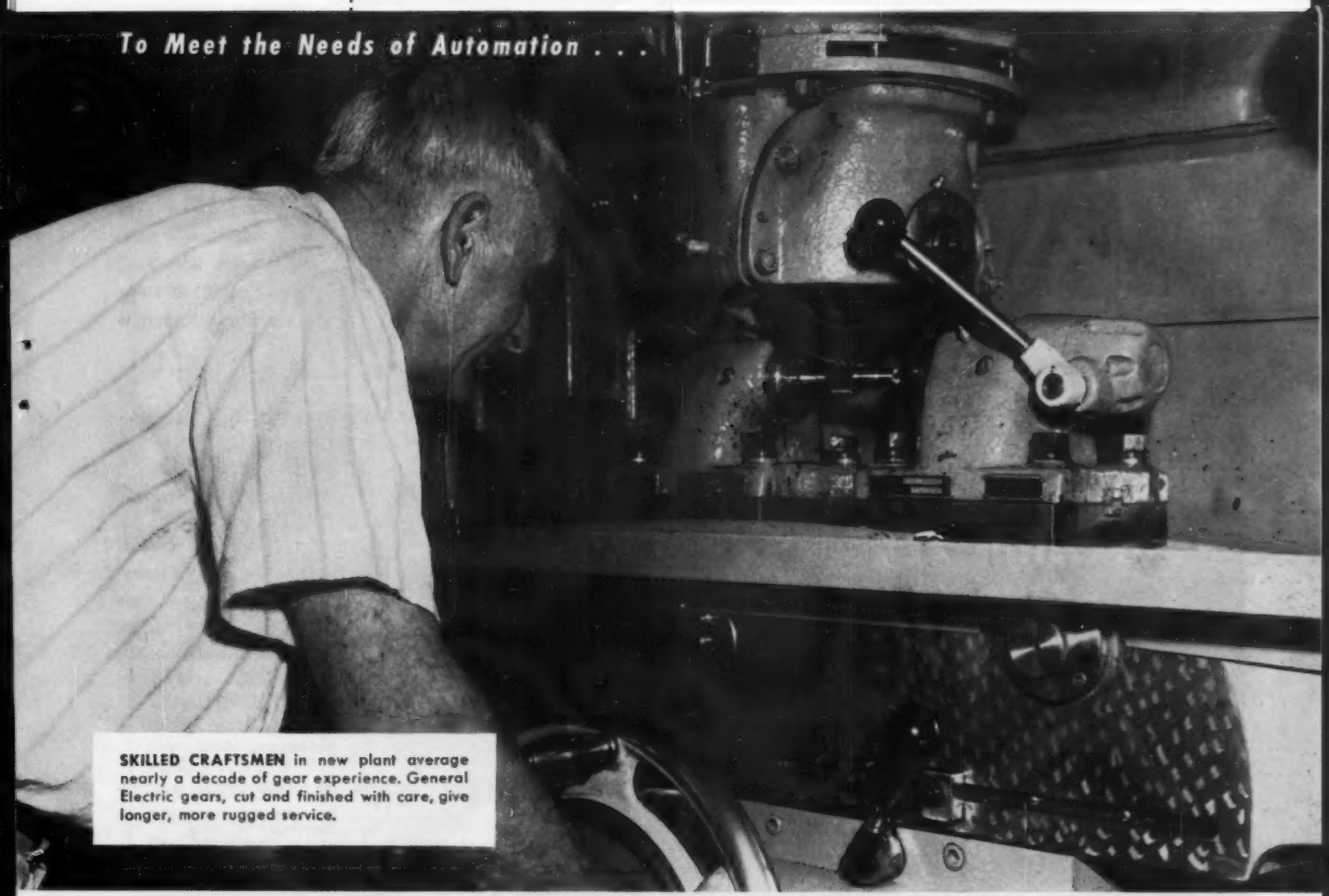

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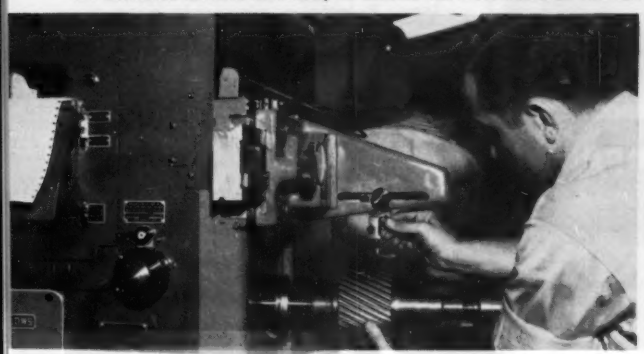

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Heller Tool Co., Heller Dr., Newcomerstown, Mich.
Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw,

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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fulmer Co., C. Allen, 1200 - 1st Nat'l Bank Bldg., Cincinnati 2, Ohio
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.

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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Mch. Tool Corp., 3401 Central Parkway, Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

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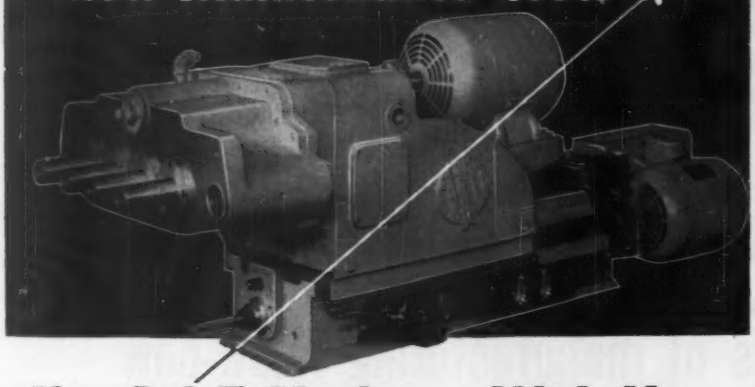

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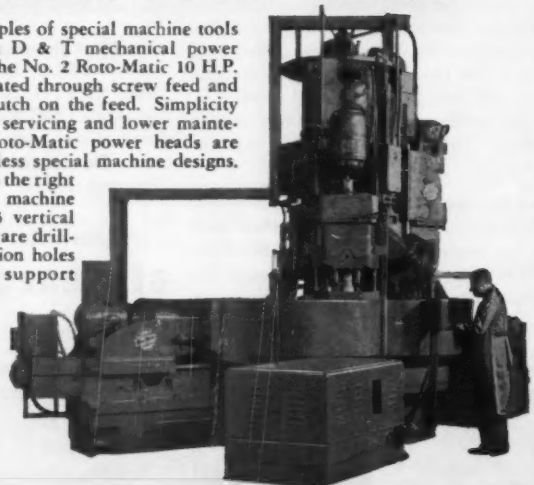

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25 Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

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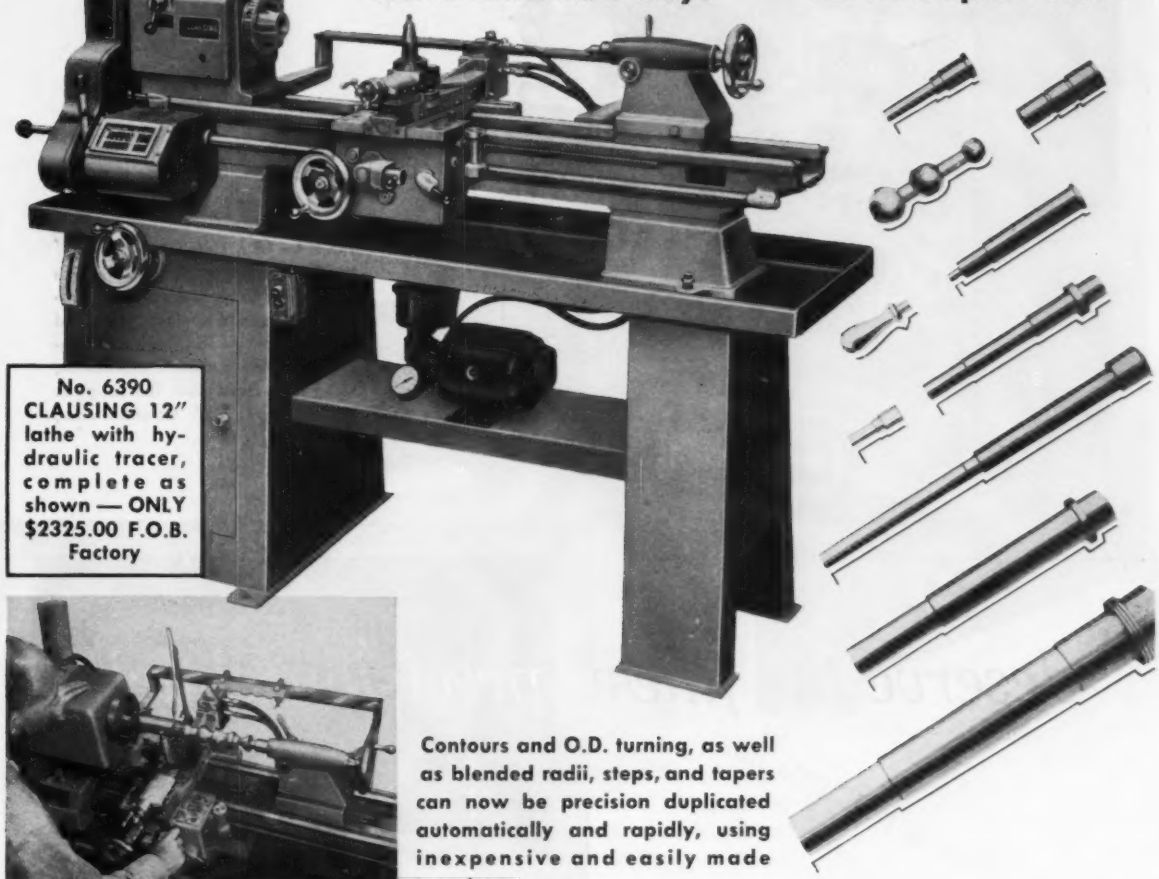
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.

(Continued on page 352)

NEW CLAUSING 12" LATHE with *Hydraulic Tracer*

Flame Hardened Ways • Variable Speed Drive



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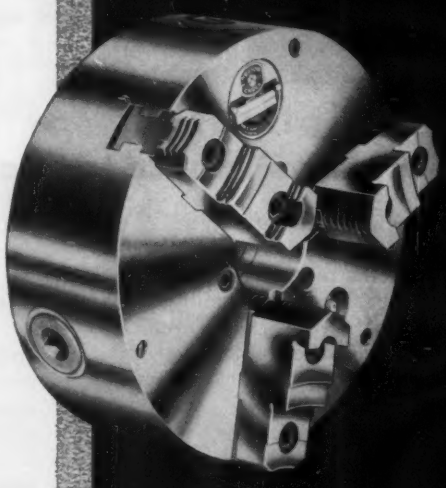
the finest high speed lathes

Photo courtesy Lodge & Shipley

This is the NEW Lodge & Shipley 10" Hi • Turn Lathe which joins the line famous for lathe leadership. It provides high speed turning, boring and facing capacity for production departments. For complete information, write for Bulletin 300, The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

deserve the finest precision chucks



This is Horton's 3-Jaw Scroll Universal Chuck which for over 100 years has been the ideal complement to the world's finest tool room, general purpose and production lathes. Its precision and lasting accuracy make it a part of any production picture. For the complete story on this and Horton's complete line of precision chucks, see the Horton people in your area now.

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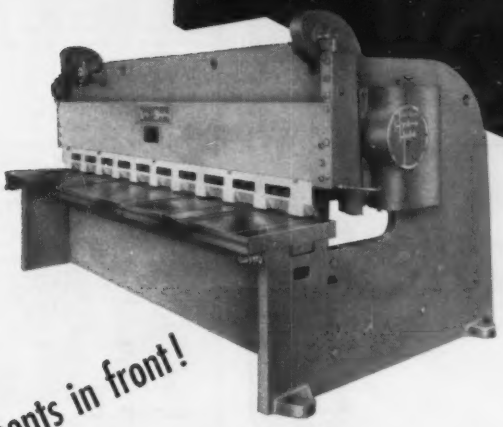

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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Carroll-Jamieson Mch. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hydra-Feed Mch. Tool Corp., 730 W. 8 Mile Rd., Ferndale 20, Mich.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

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Carroll-Jamieson Mch. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
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Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
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LATHES, Gun

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
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Wickes Brothers, 512 No. Water St., Saginaw, Mich.

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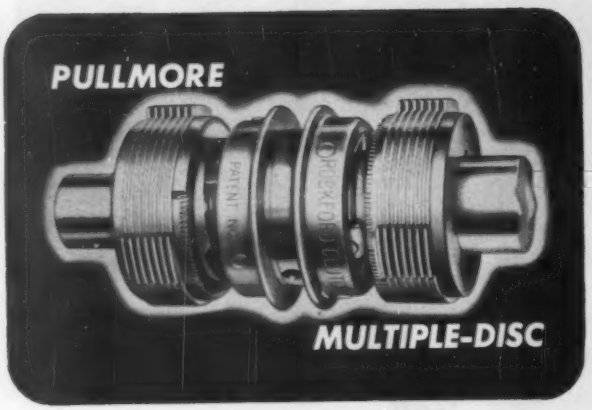
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

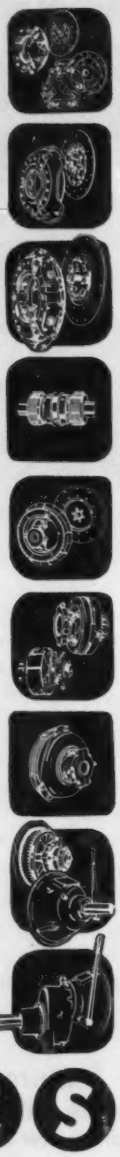
LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

(Continued on page 354)

ROCKFORD





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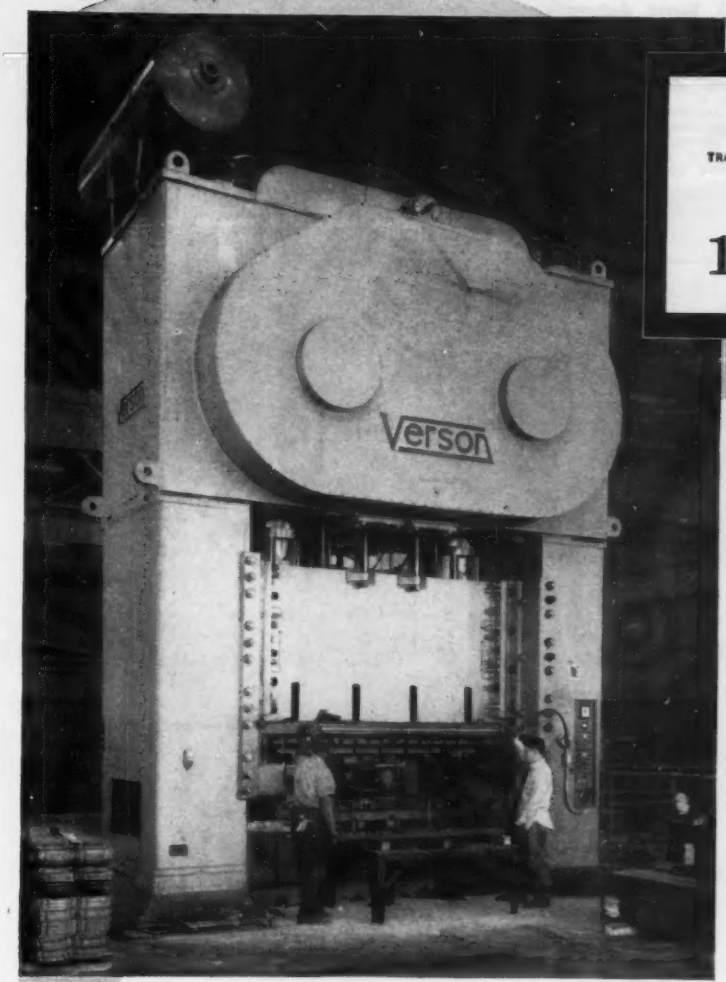
CLUTCHES

Front to Back Crank Arrangement of this

TRADE **Verson** MARK

1800 Ton Press



eliminates need for extra long shaft

Verson Presses offer features that bring accuracy, dependability and economy to a wide range of metal forming operations. The Verson Allsteel Frame, anti-overlap clutch and brake unit, square type gibs and non-oscillating vertical type adjusting screw are examples of the engineering and design that are a part of every Verson Press.

The press illustrated is a Verson 1800 Ton, twin gear, double crank. Two crankshafts are arranged front to back to eliminate the necessity of an extra long crankshaft. Gearing for the press can be installed and removed through the front of the crown allowing installation in areas with low overhead clearance. The machine was built to J.I.C. standards and has all electrical wiring and equipment, lubrication piping, air piping and controls installed internally.

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Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgewater 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Nat'l Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type
Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

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South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

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Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.
General Electric Co., Schenectady, N. Y.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

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Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

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Michigan Drill Head Co., Van Dyke, Mich.
Miles Mchry Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

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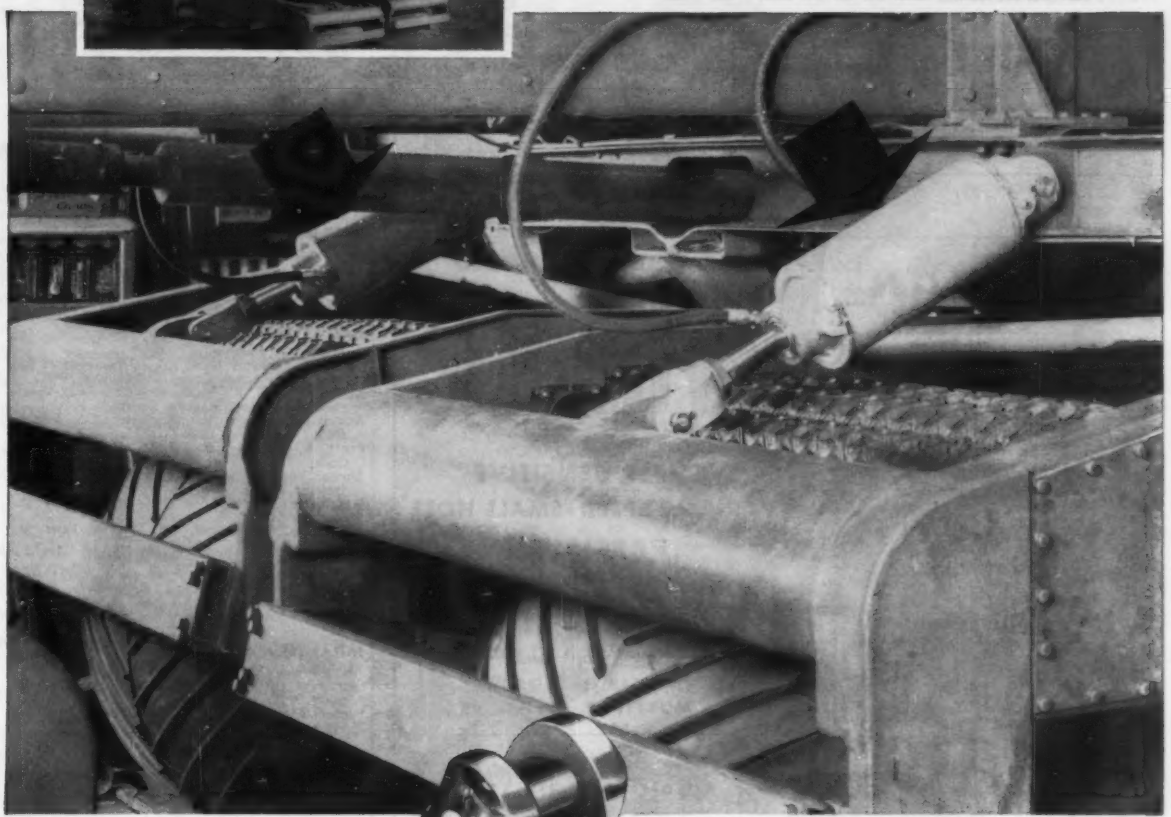

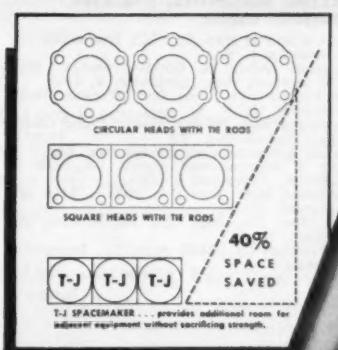
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Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

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Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Throudwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

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DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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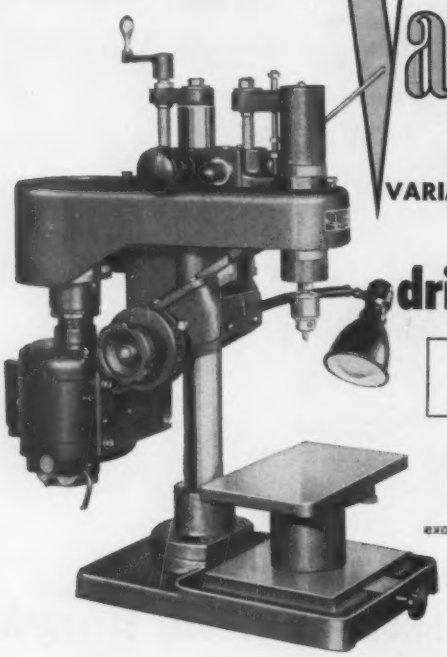

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Jones & Lamson Mch. Co., 160 Clinton St.,
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

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Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal
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Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Knee Type Ram
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type, Turret
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

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Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread
Coulter Mch. Co., James, Bridgeport 5, Conn.
Lees-Bradner Co., The, Cleveland 11, Ohio
Waltham Mch. Wks., Inc., Waltham 54, Mass.

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(Continued on page 358)

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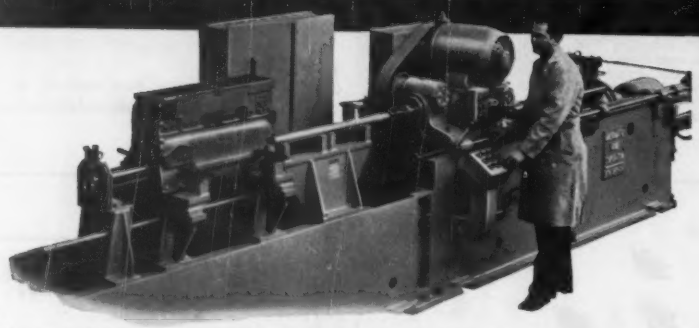
2408

WHY CUMMINS main bearings are MICROHONED

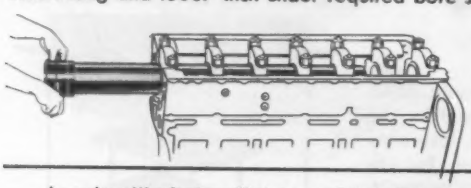


"Cummins diesel engines have a world-wide reputation for dependable, low-cost power. Here at Cummins, we attribute the wide acceptance of our engines to constant searching for better processing methods and improved engine performance.

"For example, if our crankshaft main bearings were undercut at the ends, tapered or out-of-round, then the full load of the journals would be borne by relatively small areas. This would cause bearing inserts to overheat and quickly break down. Also, should the bearings be misaligned, the crankshaft would flex during rotation and cause fatigue failure.

"However, by Microhoning our main bearings we secure *round, accurately-sized* and *aligned bores*. Cummins is the first diesel manufacturer to Microhone its main bearings. The surfaces of Microhoned bearings are clean-cut, free of deformed metal and the finish is consistent in every bore. In addition, the consistent accuracy generated by Microhoning permits us to make faster set-ups and use higher cutting feeds on preceding boring operations—Microhoning automatically corrects all inaccuracies.

"After Microhoning, all main bearing bores are checked with a gage plug 44 inches long and .0007 inch under required bore size. Gage must have a simultaneous slip-fit through all bores in the block. Tolerance for roundness is less than .0002 inch and finish is held to the specified 55 microinches."



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Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
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Vickers, Inc., Detroit 32, Mich.

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Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead Ave., Hartford 12, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K., Mchry. Co., Inc., Indianapolis 20, Ind.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NAMEPLATES
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Wales-Strippet Corp., North Tonawanda, N. Y.

NICKEL AND NICKEL ALLOYS
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

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NUTS—See Bolt, Nuts and Screws

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OILERS AND LUBRICATORS
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Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

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OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
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Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.
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Michigan Drill Head Co., Detroit 34, Mich.
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Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
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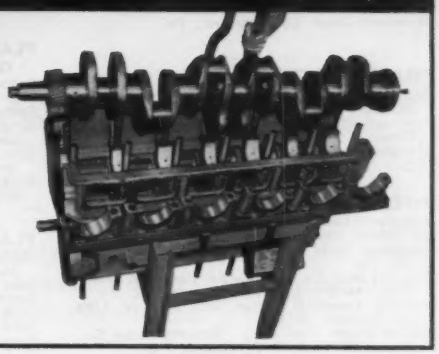
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

(Continued on page 360)

HOW MICROHONING generates round, accurate, aligned bearing bores



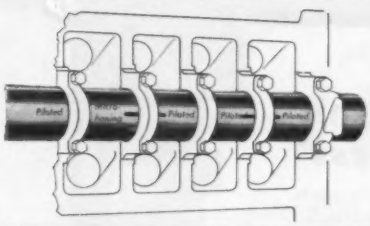
All types of cylindrical surfaces, including small diameters and combinations of soft and hard metals . . . interrupted by keyways, undercuts, ports, reliefs or cross holes . . . can be economically Microhoned to precision tolerances and alignment.

A typical example of Microhoning interrupted cylindrical surfaces is the Cummins Diesel Engine application. Here's how Microhoning generates accuracy and alignment in the crankshaft main bearing bores:

1. Cutting pressure is applied radially from the center of the Microhoning tool body. Abrasives and guides both are expanded by the same feed force, and wear at the same rate.

2. Abrading action is divorced from the effects of spindle or driveshaft vibration and misalignment by a universal joint that is between tool body and driveshaft.

3. The single bank of abrasives travels through all bores on every stroke. As abrasives are Microhoning one bore, the tool is piloted by the plastic guides in the other bores.



The principles and applications of Microhoning are thoroughly explained in a 16mm, 30-minute sound movie, "Progress in Precision". We'll be glad to reserve a print for your use.

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DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester Mass.

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Mummert-Dixon Co., Hanover, Pa.

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Standard Pressed Steel Co., Jenkintown, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
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United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

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Consolidated Mch. Tool Div., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Bliss Co., E. W., Canton, Ohio
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
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Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
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Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
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Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Ferracute Machine Co. Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic
American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.

(Continued on page 362)

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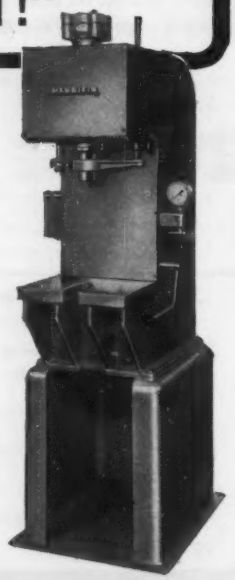

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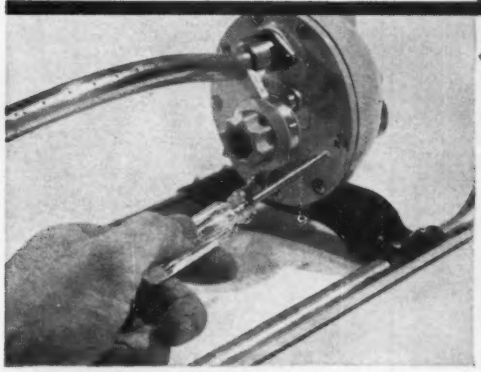

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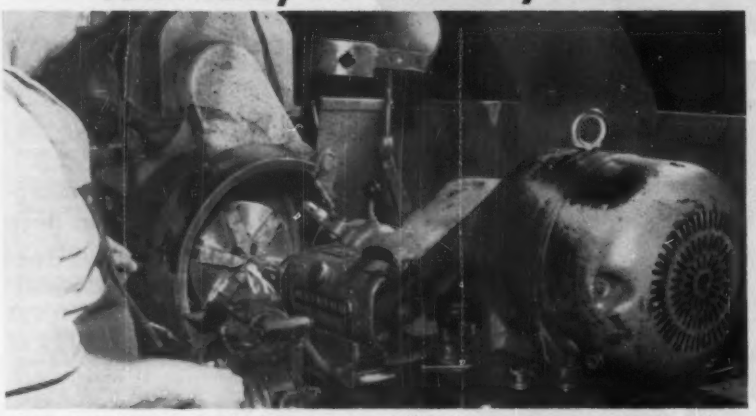

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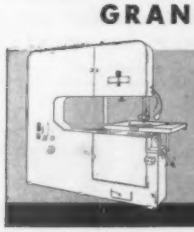

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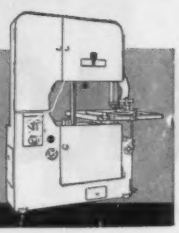

Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Detroit Broach Co., (special & semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426 Clinton, Mo. (Bench)
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Machine Co., Process Machinery Div., Cincinnati 9, Ohio
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Cleaning Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., Elkhart, Ind.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Straightening

Anderson Bros. Mfg. Co. 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.

(Continued on page 363)

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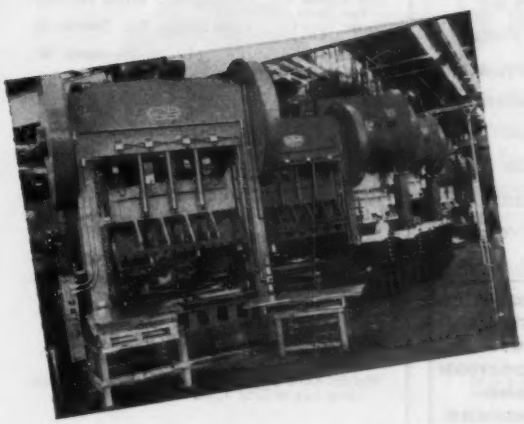

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Sales Manager
Hydraulic Press Division
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MODEL 37KMD
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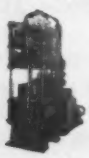

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Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS
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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic
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Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
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Wilson, K. R., Arcade, N. Y.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Goddard & Goddard Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
McCrosky Tool Corp., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
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Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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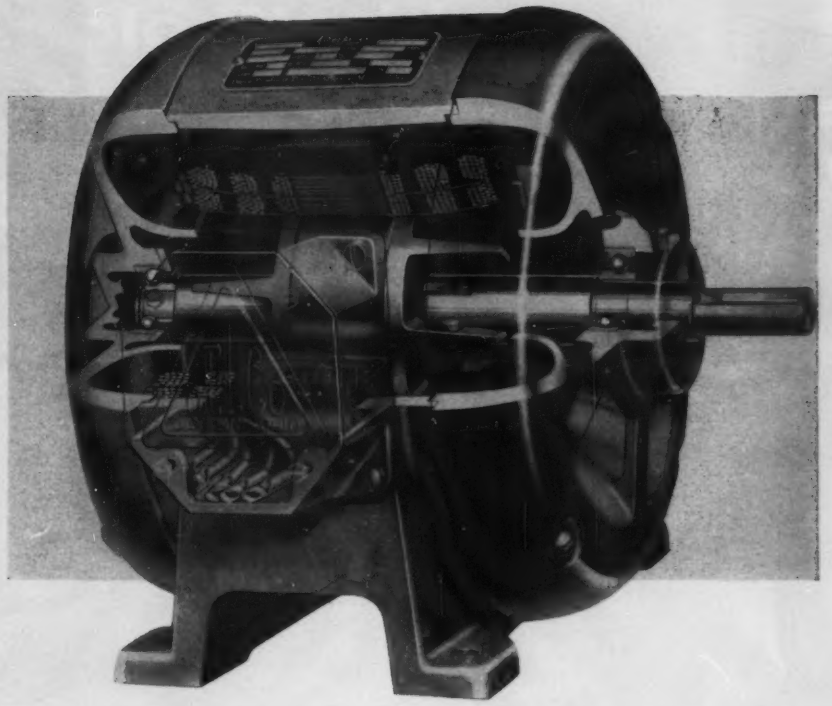

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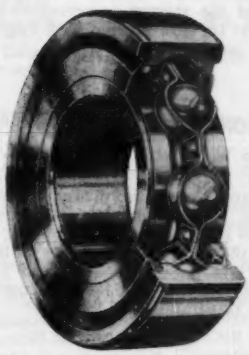

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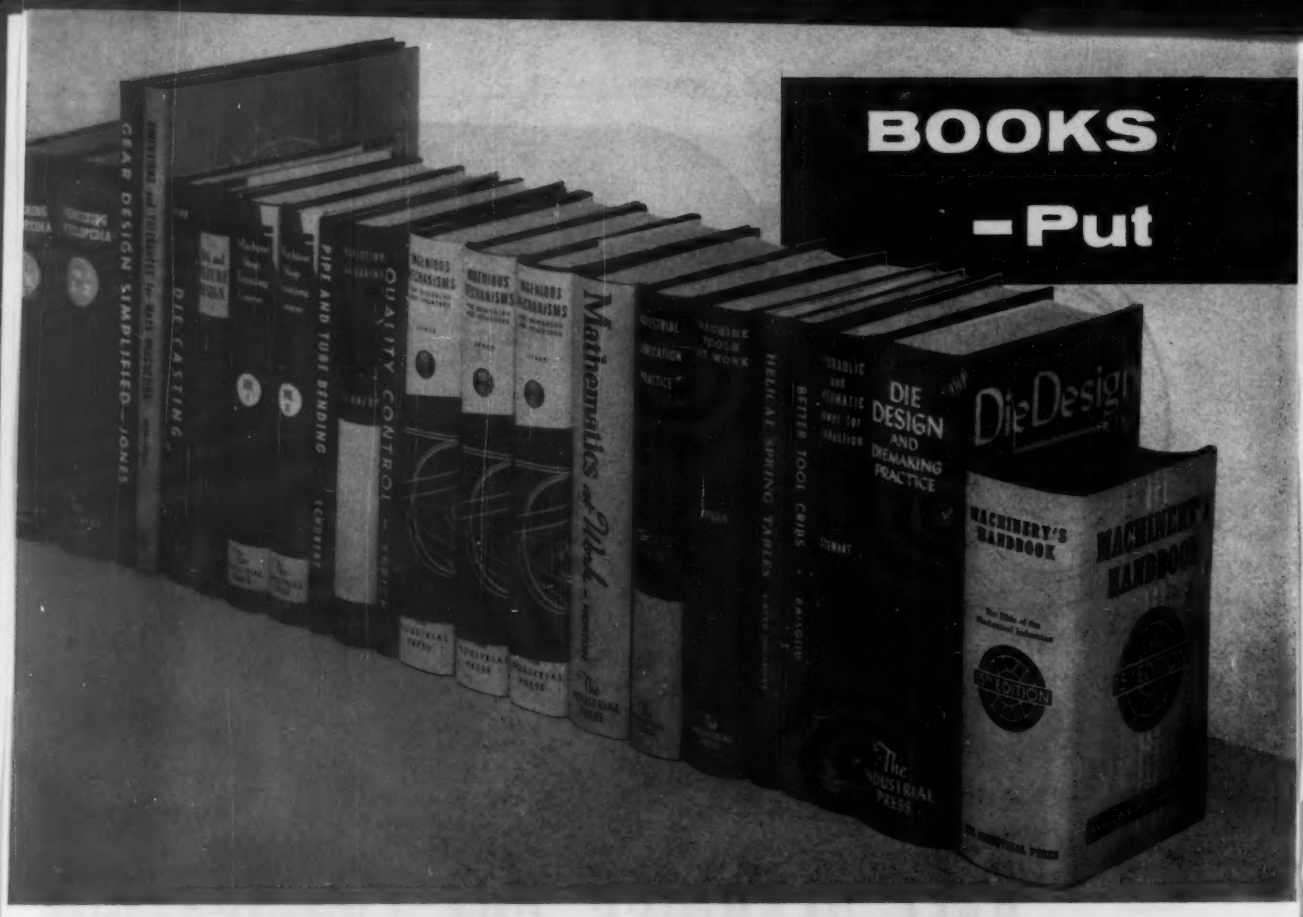

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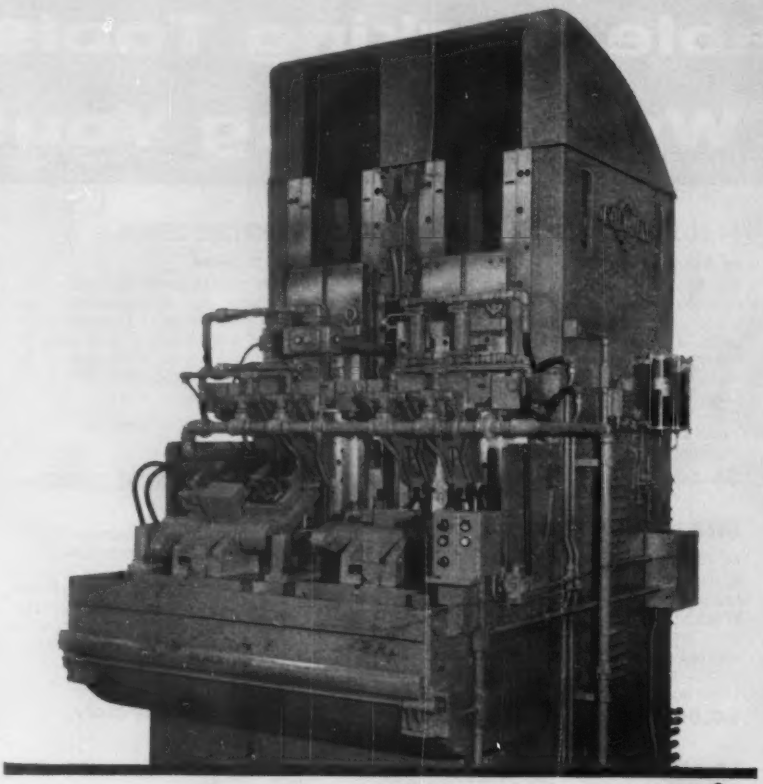

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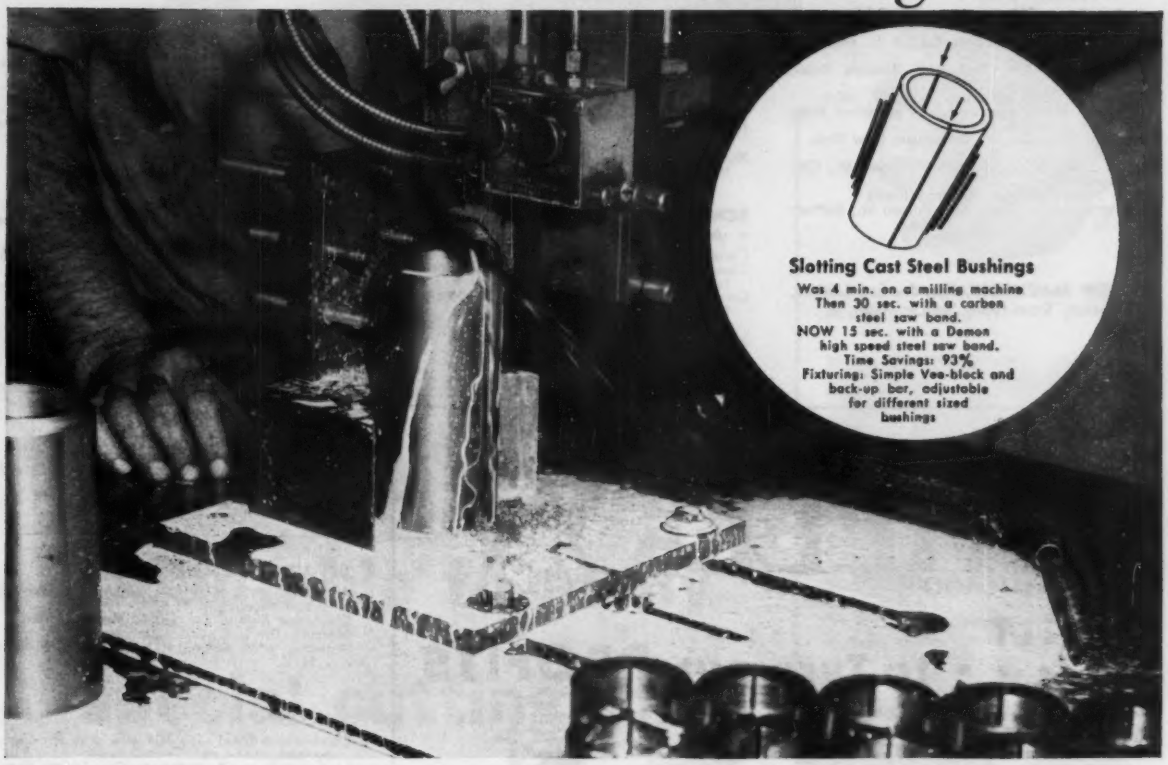

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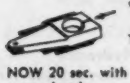

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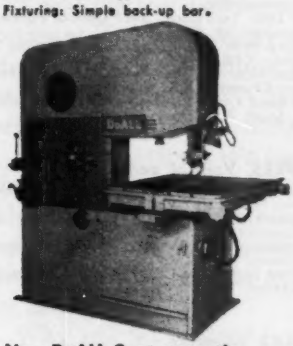

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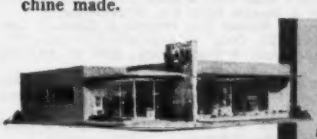

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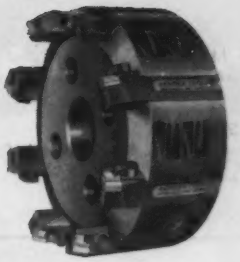

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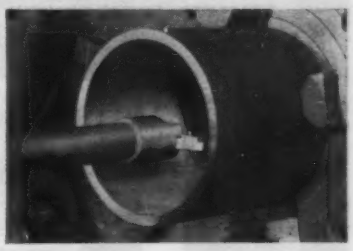

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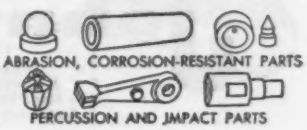

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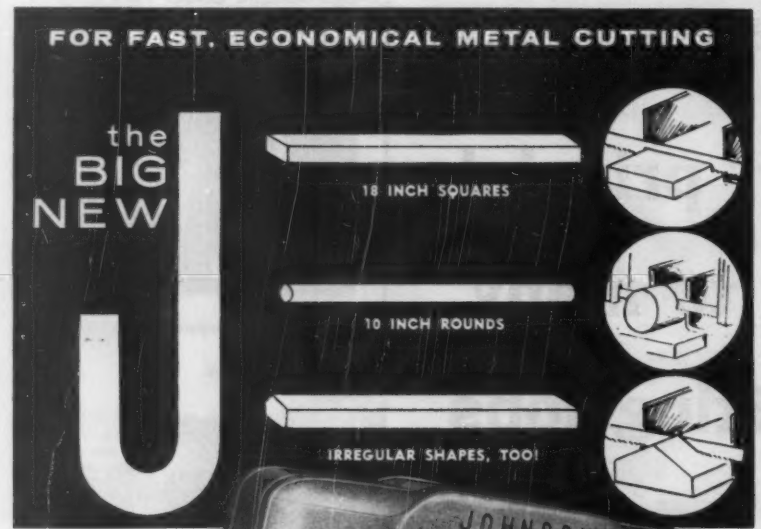

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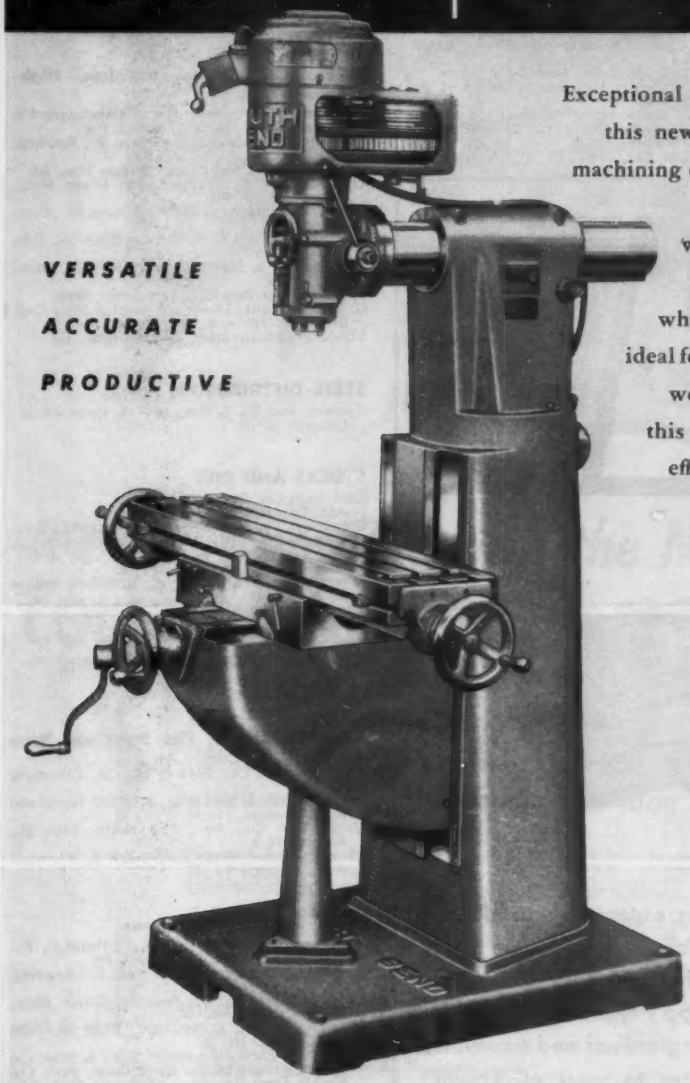
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros., & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg., Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St. Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

(*Continued on page 374*)

New SOUTH BEND VERTICAL MILLING MACHINE

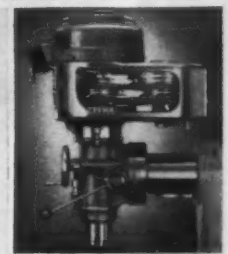


VERSATILE

ACCURATE

PRODUCTIVE

Exceptional versatility, accuracy and speed give this new milling machine the ability to keep machining costs low. Its simplicity of design provides ease of accessibility and set-up which simplify operation and job change-overs. The wide variety of jobs which it can handle makes this machine ideal for toolroom, production and maintenance work. It will pay you to find out how this new milling machine can give you greater efficiency—write for information.



LO-LOSS spindle drive. Precision ground and fitted quill.

Positive action controls with large, adjustable, graduated collars.

Manual table feed standard equipment.

Power longitudinal table feed and automatic quill feed optional.

SPECIFICATIONS

Longitudinal table travel	20″ or 30″
Cross feed	9½″
Spindle to table (max.)	20″
Spindle to column (max.)	20″
Ram travel	15″
Spindle speeds (8)	135 to 3750 r.p.m.
Spindle travel	4″
Head rotation	360°

SOUTH BEND LATHE

425 East Madison Street
South Bend 22, Indiana

Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio
DoALL Co., Des Plaines, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Philadelphia Gear Works, Inc., Erie Ave., and G St., Philadelphia, Pa.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., S. 7th St.-N St., Richmond, Ind.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio
Wadell Equip. Co., Clark, N. J.

SPRAYING EQUIPMENT, Metal

Metallizing Engrg. Co., Westbury, N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
GColumbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES

Cyril Bath Co., Solon, Ohio
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio
Lewis Machine Co., 3441 E. 76th St., Cleveland 27, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc. 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Pa.

(*Continued on page* 376)

WALKER...

and a great industry

For more than fifty years automotive production has relied on Walker holding devices. One of the most popular chucks in the Detroit area is Walker 617 CG (concentric gap) type, a rectangular chuck that combines longitudinal and transverse gaps. Produced in sizes to meet all holding requirements.

Walker engineers can solve any holding problem.

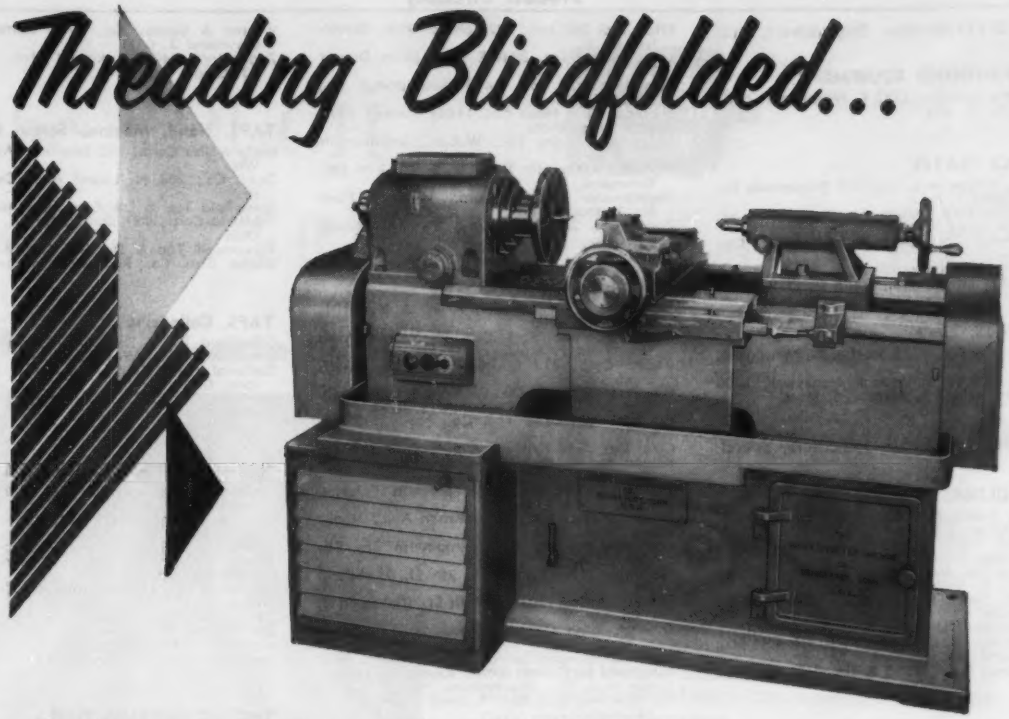
What is yours?

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

Threading Blindfolded...



It's really possible with the NEW
COULTER Model "B" THREADING MACHINE

HERE IS YOUR INTRODUCTION TO THE *NEW* COULTER MODEL "B" HIGH SPEED, SINGLE POINT THREADING MACHINE . . . *the machine with an automatic threading cycle!*

Never before has a threading machine been so easy to operate! Just put the work in, push a button and the COULTER "B" goes through a predetermined threading cycle; coming to a stop when the piece is threaded — set for the next piece, *automatically!* You never worry about the thread diameters, for the "In-and-Out" tool mechanism controls the diameters, *automatically.*

A Few Exclusive Features

- ...A worm and gear spindle drive!
- ...Work spindle operates in one direction of rotation!
- ..."Pick off" gears permit changing from one pitch to another quickly!
- ...Electrically controlled clutch assures starting and stopping on time!

Thread it Better, Faster . . . AUTOMATICALLY, with a COULTER.

For Information on the New COULTER "B", write, wire, phone.

The *James Coulter Machine Co.* **643 Railroad Ave.**
Machine Tool Builders Since 1896 **Bridgeport 5, Conn.**

For more information fill in page number on Inquiry Card, on page 263

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Challenge Mchy. Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
South Bend Lathe Wks., South Bend 22, Ind.

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.
Doelcam Div. of Minneapolis-Honeywell, 1400 Soldiers Field Rd., Boston 25, Mass.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING HEADS
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., 11449 Timken Ave., Van Dyke, Mich.
Millholland Mchy Co., W.K.M., Indianapolis 20, Ind.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar Co., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPPING MACHINES
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Cincinnati Bickford Div. Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Mchry. Co., 37 Huntington St., Cortland, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPS, Hand, Machine Screw, Pipe, etc.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES
Coulter, James Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Michigan Drill Head Co., Van Dyke, Mich.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Eastern Mch. Screw Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Star Cutter Co., 34500 Grand River, Farmington, Mich.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio

TOOL CONTROL BOARDS
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

TOOL HOLDERS
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., So. Beloit, Ill.
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Conforming Matrix Corp., Toledo, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Eastern Mch. Screw Corp., Truman & Barclay Sts., New Haven 6, Conn.

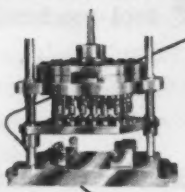
(*Continued on page* 378)

FOR MULTIPLE DRILLING OF HOLES ON PRODUCTION RUNS . . .

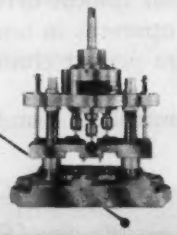
ERRINGTON

FIXED CENTER DRILLING HEADS with JIGS and FIXTURES

Do more . . . and do it better with Errington Fixed Center Drilling Heads. They drill any number of varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears of one piece turned from solid bar stock. It is geared approximately 2:1. All enclosed in a sand-cast aluminum case and cover, with alemite pressure lubrication.



Custom Built to Your Specifications. Send Blueprint for Quotation Without Obligation.



Write for Complete Information

ERRINGTON Mechanical Laboratory, Inc.

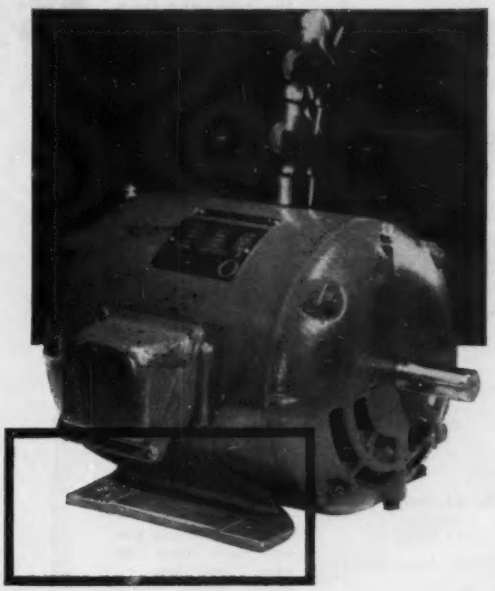
Established 1891

Main Office and Plant STATEN ISLAND 4, NEW YORK

the TOUGH STEEL FRAMES and FEET

PLUS values in power

of HOWELL series one hundred motors give you



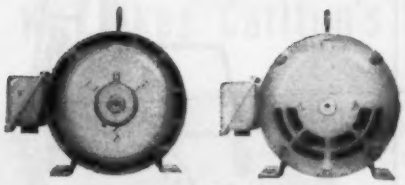
A MORE RUGGED MOTOR CONSTRUCTION, GREATER "INSTALLATION FACILITY"

The die-formed, cold-rolled steel frame of a Howell Series 100 motor takes the impact of a dropped hammer or other accidental blow with hardly a dent . . . and never a crack to show. Or take the more common installation accidents . . . too much tightening on the mounting bolts or the shock of the motor dropped too hard. Howell's steel mounting feet have the resiliency to take punishment that would crack the ordinary cast iron mountings.

In the end-plates, where rigidity is essential for constant bearing and shaft alignment, Howell uses cast iron.

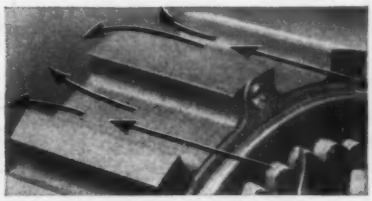
It all adds up to "installation facility" . . . meaning freedom from trouble when these motors are being put to use on machines. Consider the delays and expense you can save by reducing motor damage and you'll specify the modern steel frame construction of Howell Series 100 motors every time.

GET THE PLUS values THAT COUNT....specify HOWELL series 100 motors



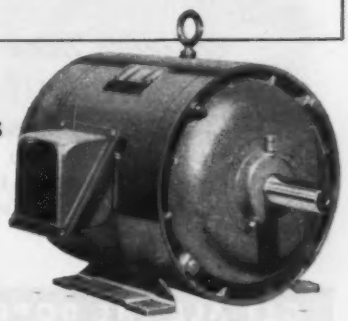
TEFC—open interchangeability

The totally enclosed fan-cooled and open drip-proof or weather-protected types of Howell Series 100 motors have all major dimensions alike, except length. Emergency interchanges are easy.



heat-source ventilation

Wide slots in the stator provide 50% more contact between cooling air and stator laminations, main source of motor heat. Cool running Series 100 motors last longer.



smaller, lighter, better looking

Save machine and storage space, save shipping weight, and get new functional streamlining that matches the motor to your most modern machine design or production equipment. Why put up with dust catching fins on a motor, when sleek good appearance costs no more.

For more details on Series 100 motors, write for Bulletin N-100-R

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

For more information fill in page number on Inquiry Card, on page 263

CUT A KEYWAY for 1 CENT

Using a Minute Man Keyway Broach Kit, you can cut keyways for as little as a penny a piece in just one minute. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

Minute Man

SQUARE BROACHES

For finishing cast or drilled holes in one pass. In stock for 3/16" to 3/4" squares. Hexagon broaches and Production Type Keyway Broaches also in stock.

GET ALL THE DOPE

The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST M describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
McCrosky Tool Corp., Meadville, Pa.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown 12, Ohio
Spiral Step Tool Co., Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
du Mont Corp., 289 Wells St., Greenfield, Mass.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 30, Mich.
Spiral Step Tool Co., 5400 N. Damen Ave., Chicago 25, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.

TRACING ATTACHMENTS

American Tool Works Co., Cincinnati 2, Ohio
Atlas Press Co., Kalamazoo, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Sidney Mch. Tool Co., Sidney, Ohio
Wales-Strippit Co., N. Tonawanda, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

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Boston Gear Wks., Quincy, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland 4, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

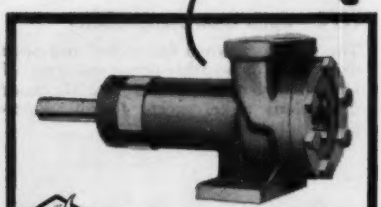
(*Continued on page* 380)

VIKING supplies the Oomph

One little Viking Pump supplies the hydraulic power to raise this lift up to 38 feet. The stand can be raised, lowered or stopped at any level from the ground or stand, simply by starting or stopping the electric motor-driven pump.

Used in motion picture studios for lighting equipment and camera work, this lift is manufactured by Hamlin Hydraulic Lifts, Monrovia Machine Works, San Gabriel, California. They also make portable hydraulic lifts for factory maintenance crews, storage room stackers, scaffolding stands, light bulb changers, orchard sprayers, casket lifts, and many others. Hamlin has built these lifts for more than 20 years, and has included Viking Pumps as an integral part of each unit.

If you're looking for positive, dependable pumping, learn more about Vikings. Write for Bulletin 565j.



VIKING PUMP CO.
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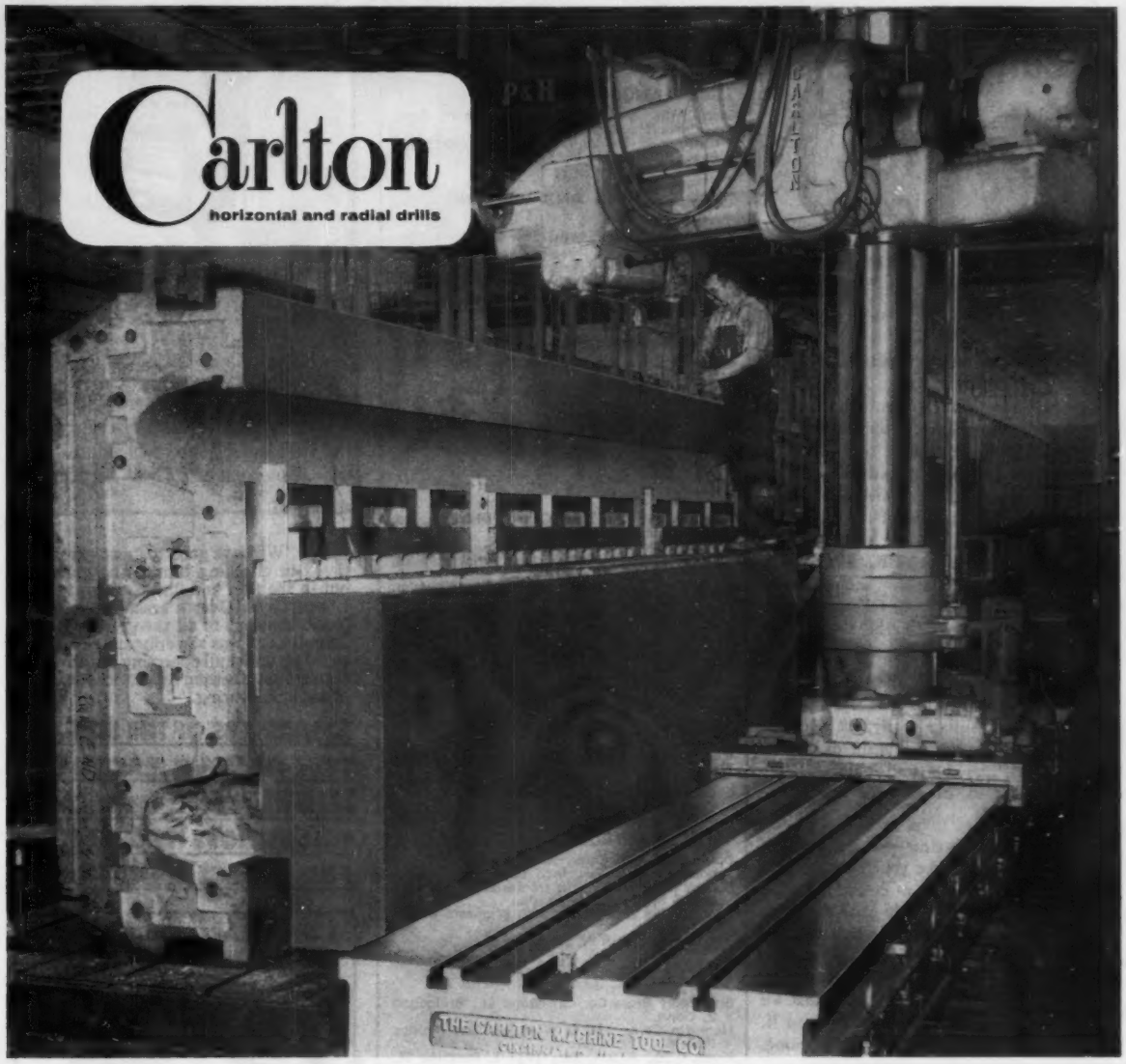
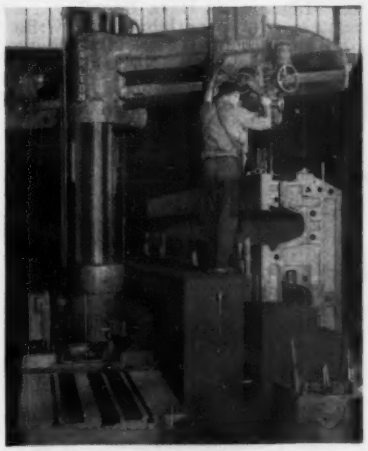


K&T likes Carlton's hole drilling mobility and accuracy



This Carlton radial drill really "gets around" at Kearney & Trecker Corp., Milwaukee. A special sliding bed plate brings Carlton's hole drilling efficiency to bear over the entire length of this enormous 23-foot long K&T milling machine base. It drills 216 holes at one setting without the necessity of lifting so much as an ounce of its 12 tons. Think what this special Carlton mounting means in time, energy and money saved!

And this ingenious mobility means even more when you add to it the many other advantages of Carlton radial drills: low-hung drive, super-precision column clamp, 3-unit power clamping, positive tooth feed clutch and easy, economical maintenance. Arm lengths from 3 feet to 12 feet, column diameters from 9″ to 26″. Send today for descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

For more information fill in page number on Inquiry Card, on page 263

Sam Made The PANTS TOO LONG

PRESIDENT, THE CINCINNATI GEAR CO.

Some time ago I had a friend who decided (as I guess everyone has at some time) that the best way to get a good suit would be to buy some cloth that he particularly liked and then have the suit "made to measure" by a tailor. The purchase of the cloth presented no problem, but the selection of a tailor was another matter. He finally chose a small, inconspicuous one-man shop someone suggested to him; the poor fellow who ran it looked half starved, so he assumed he was about to get a real bargain.

After a reasonable wait, he got the suit; but it was a *terrible* fit. He went back for "alterations." It still fit poorly, but he didn't have the heart to go back again to the old man and tell him the truth — that his suit was no good. So, he gave the suit to his yard man.

The moral of this is clear — unless you're a gambler by nature, take your business to a shop that is big enough to do the job right in the first place, or to *make good* if it turns out wrong. This moral holds true whether you're buying suits or custom gears. Our reputation of nearly 50 years of virtually invariable customer satisfaction shows that we are equipped to do the job right — and if, by some chance, there *is* something wrong, we correct it to your complete satisfaction — almost quicker than you can say "Sam, you made the pants too long!"

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CINCINNATI 27, OHIO
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Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

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Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
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National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
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Vickers, Inc., Detroit 32, Mich.

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Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

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Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
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Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
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VERNIERS—See Calipers, Vernier; Gages, Vernier

(Continued on page 382)

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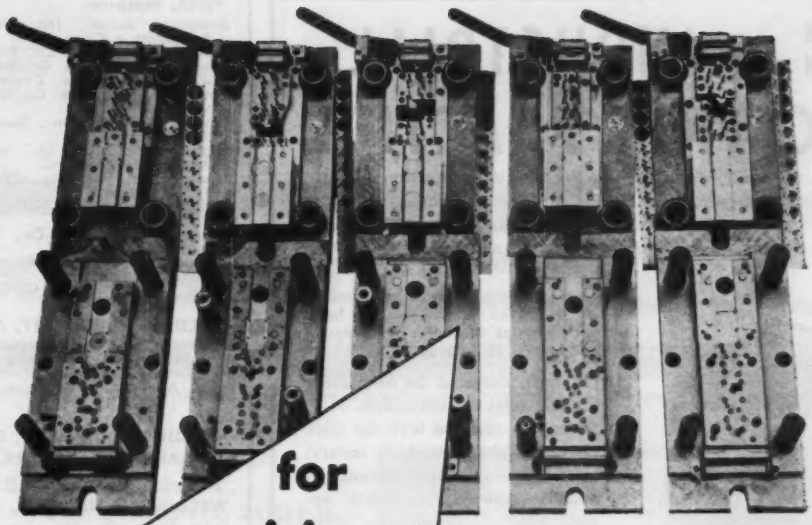

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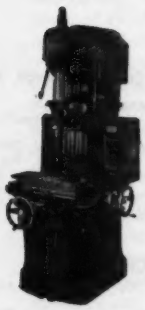

NO. 2 MOORE JIG BORER. Range 10" x 16" x 16" height. Features infinitely variable spindle speeds, three power feed ratios, centralized controls.

NO. 2 MOORE JIG GRINDER. Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up or down; spindle-housing heat control; features slot grinding attachment.

Moore Jig Borers and Jig Grinders are made to order for jobs that require precision hole location—and plenty of it.

Take, for example, these five progressive compound dies used to pierce, shave, gut and blank intricate timing-device parts.

Holes in punch plate and stripper were jig bored in a No. 2 Moore Jig Borer. Holes in the corresponding die parts were jig bored in the same precision machine, hardened and then jig ground in a No. 2 Moore Jig Grinder. Perfect line-up was insured, since all holes had to be held to ± .0002", both for position and hole size.

The No. 2 Moore Jig Borer, with its built-in system of accurate lead screws, can spot, drill, bore or ream all holes in a workpiece to "tenths" with minimum tool changes. The No. 2 Moore Jig Grinder can accurately contour grind, slot grind and form grind die sections in a third of the time required by other means.

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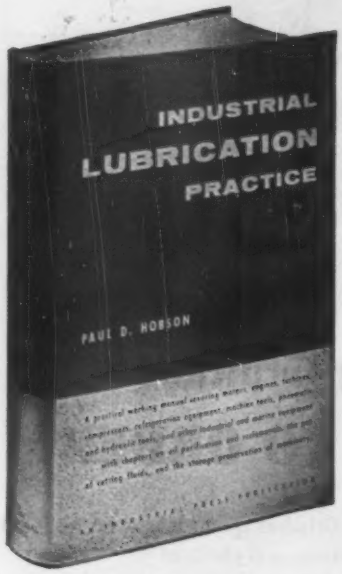

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Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch., Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hghts. Blvd., Detroit 20, Mich.

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General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
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Federal Mch. & Welder Co., Warren, Ohio

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Pope Mchry. Corp., Haverhill, Mass.

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Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

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AXELSON production and maintenance news

AXELSON MANUFACTURING COMPANY / DIVISION OF U.S. INDUSTRIES, INC. / 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

New 32" heavy-duty lathe has 75-hp headstock... handles peak loads to 100 hp.

Axelson's new 32" heavy-duty lathe is a rugged tool that can be used with equal effectiveness on rough or precision cuts. It has 24 spindle speeds in true geometric progression from 6 to 750 r.p.m.

The main bed casting is designed for maximum stability and for resistance to the twisting forces of heavy-duty turning. The carriage bed ways are hardened and ground alloy steel.

Two levers control the selection of feed changes on the new Axelson totally enclosed gear box. There are 81 feeds, ranging from .005" to .351" per revolution of the spindle; 45 threads may be cut, ranging from 1 to 30 threads per inch. This range of feeds and leads is sufficient for the large majority of all machining operations.

The extra-heavy, box-type apron is completely enclosed, which permits all shafts and gears to run in a continuous oil bath. All carriage controls are located on the apron convenient to the operator. Clutch levers operate cross and longitudinal feed controls.

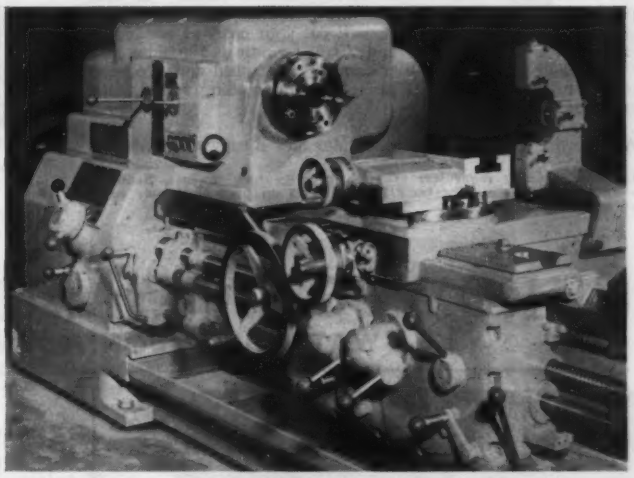
The tailstock is a rugged one-piece casting. The two-speed feature provides rapid movement of the tailstock center up to the work piece, and slow powerful movement of the spindle for feeding drills, reamers, or other tools held in center. The tailstock can be easily moved manually in either direction by a hand crank at the front of the machine.

A micrometer cross-feed positive stop, which permits the operator to set the cross-slide travel to stop at a predetermined point, is positive, will not slip, and will permit accurate dimensions to be duplicated repeatedly.

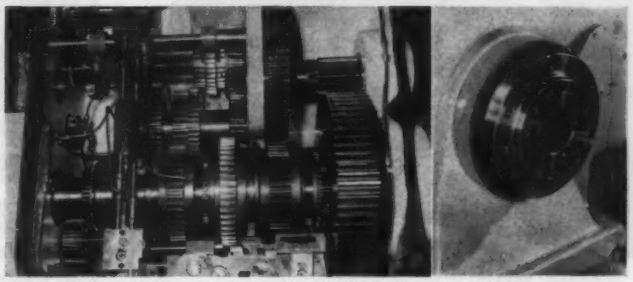
Standard equipment is the power rapid traverse for quickly moving the carriage in either direction. This feature saves valuable production time and reduces operator fatigue to a minimum. A lever mounted at the left-hand side of the carriage controls the carriage movement.

For a complete description and detailed specifications on Axelson Tool Room, Medium-Duty and the new 25/16 and 32" Heavy-Duty Lathes: Write for bulletin M4-5507 and 5504.

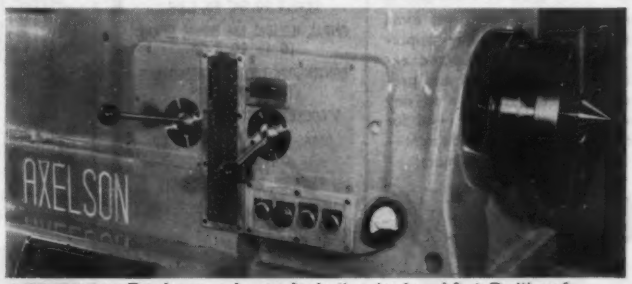
AXELSON Manufacturing Company
Division of U. S. Industries, Inc.



NEW 32" HEAVY-DUTY LATHE. Designed for flexible, effective operations, this machine combines rugged construction and precise operation.



HEADSTOCK. Twenty-four spindle speeds divided into a true geometric progression from 6 to 750 r.p.m. are ideally suited for a wide variety of work, permitting high speed turning and large diameter work in new metals and alloys.



SPEED SELECTION. Two levers make speed selection simple and fast. Position of the levers tells operator the speed at which spindle is running or the speed change desired. Automatic electric brake stops spindle instantly.

For more information fill in page number on Inquiry Card, on page 263

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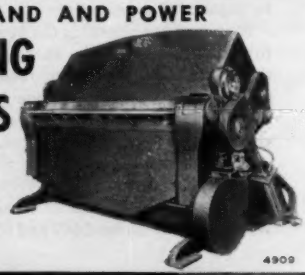

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12 geared spindle speeds provide enormous pulling power. Choice of threaded or taper key drive spindle nose. Heavy duty Precision Timken taper bearings on spindle.

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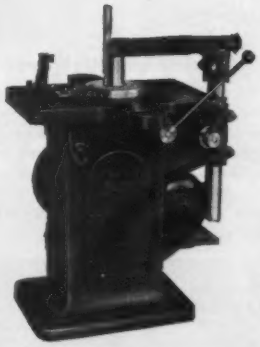

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DAVIS KEYSEATER COMPANY
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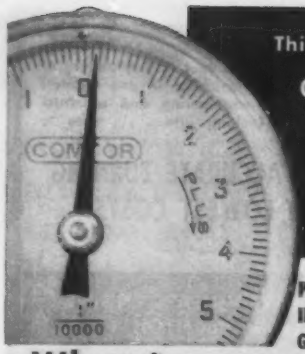

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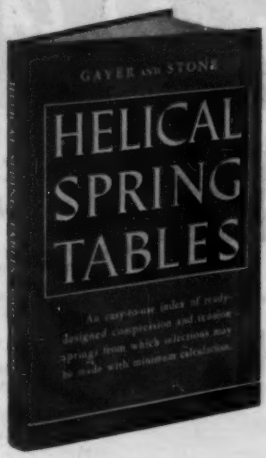

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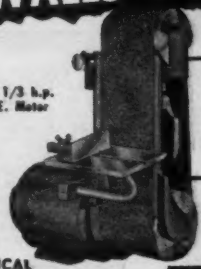

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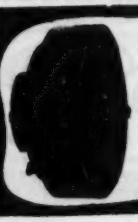

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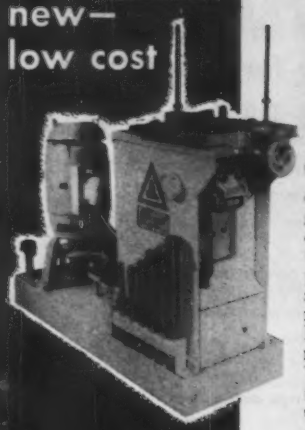

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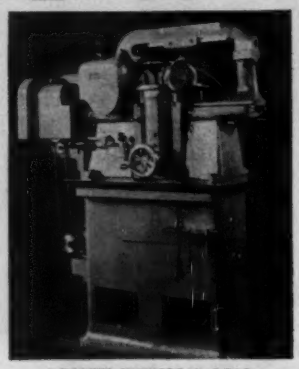

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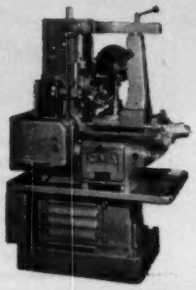

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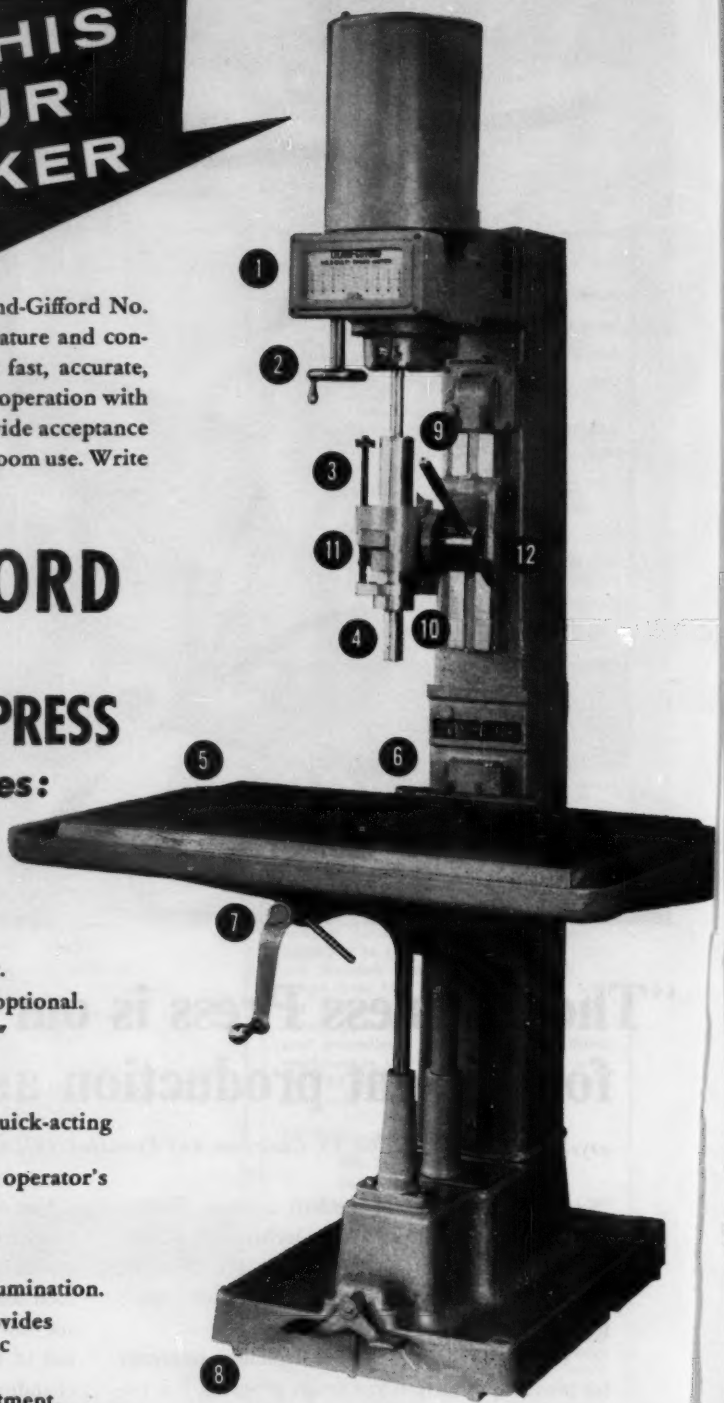

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NOW—Great news about two new Pangborn Dust Collectors!

PANGBORN VENTRIJET WET COLLECTOR

These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard., Hagerstown, Maryland.

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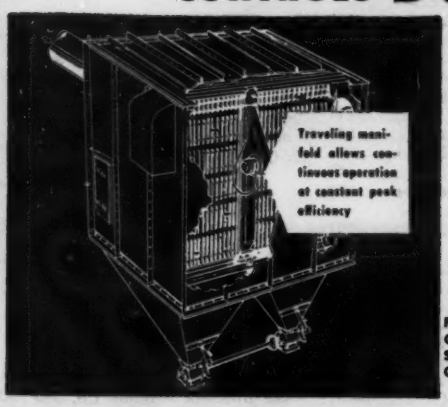

PANGBORN CONTINUOUS SELF-CLEANING COLLECTOR

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Cleveland Worm Gear Speed Reducers were specified and installed on these cage mills by the builders of the equipment—the Raymond Division of Combustion Engineering Co., Inc., Chicago, Ill.

8 CLEVELANDS drive cage mills at L.A. sewage treatment plant

STEADY, continuous operation is all-important here. Each of the 4 double cage mills in the Hyperion Treatment Plant of the Los Angeles Sewage Disposal Division are driven by 2 Cleveland Worm Gear Reducers of 30 HP capacity. Sewage sludge, reduced to 50% moisture, drops into the cage mills with furnace gases at 1300° F. Dried sludge and steam then pass through cyclone separators.

Cleveland Worm Gearing affords exceptional advantages for practically any power job. Steel worm on bronze gear provides the best possible medium to transmit power with minimum friction and wear—reduces motor speed evenly, efficiently, and quietly. Right angle drive makes a worm gear reducer compact and rugged, with few moving parts.

Get the full Cleveland story on power transmission. Write for Catalog 400; ask for technical advice on any problem you may have. The Cleveland Worm & Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Drives

New! Completely redesigned milling machine switches spindle to TIMKEN® bearings

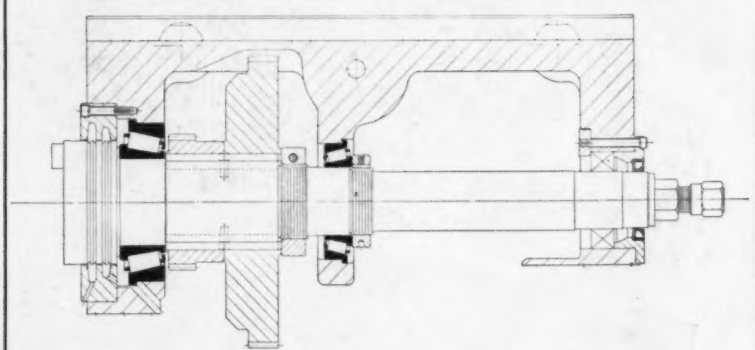
THIS Kempsmith Master-Mill, made by Kempsmith Machine Company, is a brand new, improved model—designed to meet new demands for higher production, lower milling costs. Kempsmith switched to Timken® tapered roller bearings on the new Kempsmith Master-Mill to offer users their many advantages on the spindle, on the table leadscrew, on elevating pinion, and cross feed screw.

Kempsmith reports that Timken bearings are easier to install and adjust, have greater load capacity in small space, are much easier to preload.

Timken bearings hold the spindle in rigid alignment, meeting the requirement of "zero end play over a 24 to 1500 rpm speed range". Tapered construction lets Timken bearings take the radial and thrust loads encountered by a milling machine spindle, in any combination.

Timken bearings were specified, too, because of the heavy shock loads induced by the milling cutter—shocks further amplified by interrupted cuts. Rollers and races in Timken bearings are case-carburized, with tough, shock-resistant cores under hard wear-resistant surfaces. They'll *take* heavy shock loads! And Timken bearings give extra load-carrying capacity with their full line contact between rollers and races.

Geometrically designed for true rolling motion, Timken bearings are precision-manufactured, under rigid quality controls, to conform to their design. We even make our own steel, something no other American bearing maker does. Buying or building machines like this? Look for the trade-mark "TIMKEN" on every bearing! The Timken Roller Bearing Company, Canton 6, Ohio, Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



KEMPSMITH MACHINE COMPANY mounts the spindle of their new Kempsmith Master-Mill milling machine on Timken tapered roller bearings to hold spindle in rigid alignment.

TIMKEN BEARING EQUIPPED — *This symbol on a product means its bearings are the best.*

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD